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THE ZOOGEOGRAPHY OF MARSUPIALS, WITH NOTES ON THE ORIGIN OF THE AUSTRALIAN FAUNA.

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NOTWITHSTANDING the wealth of literature on the subject, the problem of the origin of our Australian marsupial fauna is still a fascinating field for research. It is almost with trepidation that the writer enters this arena of controversy, wherein so many able authorities have expressed diverse views. None the less, it seems desirable to try and focus the results of some of our more recently acquired knowledge, together with a purview of the work of the past, so far as space and opportunity permit.

For the sake of consecutiveness it is necessary to set out, by means of extracts, some of the views of authorities. In 1893 H. O. Forbes published a formidable list of vertebrates (the majority being birds), invertebrates, and plants chiefly confined to the southern hemisphere suggesting affinities between South America, Australia, various Pacific Islands, and South Africa, from which he deduced the existence of a former circumpolar continent. When analysed to-day, however, many of the examples quoted by Forbes, with reference to Australia and South America, have lost their significance, and any affinities that remain do not afford evidence of lineal relationships requiring southern Tertiary land bridges.

In 1892 Baldwin Spencer accepted the north-western origin in pre-Cretaceous time of the monotremes and the primitive polyprotodont fauna (p. 116), spreading south and then east. Later, in his valuable summary of the results of the Horn Expedition (1896), Spencer considered that the northern origin of marsupials was practically negatived by the feeble development of the more primitive polyprotodonts in north-eastern Australia (p. 185), although he believed that the characteristic Diprotodonts had mainly developed there. He considered that Papua was the last and not the first land of the Australian region to be reached by the marsupial fauna.

Haswell (1914), in his interesting review of the Australian fauna, considers (p. 217) the connection between Australia and South America "at some time antecedent to the Pliocene" to be clearly established.

In several papers (1893, 1895, 1899, and 1912) Hedley has argued for the Antarctic origin of our most characteristic fauna, and his advocacy carries weight.

Hedley (1899) wrote of "a rich fauna of Antarctic origin, which, entering by Tasmania, overran the whole continent, crossed Torres Strait into New

NOTE—The substance of this paper was given before the Zoology Section of the Pan-Pacific Conference in Sydney, August, 1923.

Guinea, and reached its utmost eastern limit in the Solomons. Characteristic members of it are the marsupials, monotremes, cystignathous frogs, venomous snakes, and snails of the Order Macrognatha." Using Tate's term, he calls this the Euronotian element, and claims it as the most characteristic fauna. In his address to the Linnean Society of London in 1912, Hedley states: "In Australia marsupials and monotremes are least developed in the North; proceeding southward more groups successively appear till ultimately Tasmania has, as Professor Spencer expressed it, 'a condensation of most that is noteworthy in the Australian Region.'" This aspect of the Antarctic theory appears to the writer to be open to adverse criticism. It is advisable to analyse first living species of Polyprotodontia.

Dasyuridæ.—The supposed paucity of polyprotodont forms in Papua and north-eastern Queensland must be examined in the light of recent work, which has greatly increased our knowledge of the range of present-day and fossil marsupials. In this "Papuan" (Hedley) or "Torresian" (Spencer) sub-region, we find *Dasyurus maculatus*, *geoffroyi*, *gracilis*, *hallucatus*, *albopunctatus*, and *dæmonellus* (Thomas, 1904), the last two species being Papuan, and there is a doubtful record of *viverrinus* for Queensland in our State Museum. The known species are found to be very strongly represented in north-eastern Australia. In the genus *Phascogale* we find that the following species (subspecies omitted), have been described from the Torresian region during the last twenty years or so:—*lorentzii*, *nouhuyou*, *naso* (three species from Dutch Papua, described by Jentink in 1911), *murex* O. Thos., 1913 (Papua), *melanura* O. Thos., 1912 (Papua); *bella* O. Thos., 1904, *minulus* O. Thos., 1906, and *ingrami*, O. Thos., 1906, are Northern Territory species; *godmani* O. Thos., 1923, comes from North Queensland. When these records are added to previous ones, the great majority of species of *Phascogale* are seen to be in the northern region. It is somewhat surprising to find that the known distribution of the allied genus *Sminthopsis* has been much more restricted, although the majority of the species now described are found in the northern region, and *S. rufigenis* was recorded for the Aru Islands in 1922 by Oldfield Thomas. When genera and species are considered, taking fossil as well as present-day forms, it is found that, instead of the polyprotodont marsupials being feebly developed in the northern region, it is there that they are most strongly represented.

In the opinion of Bensley (1903) and of Gregory (1920, p. 159), *Myrmecobius* is a specialised dasyurid. Wood Jones (1923, p. 126) has remarked that it is greatly handicapped by its habits: "It does not excavate deep burrows, it does not climb, it is not fleet of foot." The gradual restriction of its range in recent years suggests a far wider distribution in the past.

Peramelidæ.—During recent years we have added greatly to our knowledge of the Peramelidæ. In 1909 Allen and Barbour (*loc. cit.*) described the new genus *Suillomeles* for a species (*hispida*) from Dutch Papua. In 1920 the genus *Rhynchomeles* was established by Oldfield Thomas for a species (*prattorum*) found

in Ceram. The genera *Echymipera* and *Peroryctes*, now separated from *Perameles* and *Isoodon*, are distinctively Papuan. The writer has no knowledge of the characters of *Anuromeles*, Heller (1897), from Papua.

In 1903 Bensley pointed out that "Of the Peramelidæ all the species representing prototypal forms are Papuan" (p. 204). In 1923, with the addition of new genera and species the range and diversity of the Peramelidæ are far more significant. It now appears to be definitely established that the radiation of the Australian forms emanated from Papua, *Thylacomys* and *Chaeropus* being specialised offshoots.

The discovery of new northern genera of peramelids is also of special interest in view of Osgood's opinion that this family exhibits characters suggestive of the incipient stages leading from polyprotodont to diprotodont groups. This is strengthened by their common syndactylism.

Osgood also states (1922, p. 135) that "the conclusion is unavoidable that among living forms those most suggestive of what the ancestor of *Cœnolestes* and other diprotodonts was like, are the Peramelidæ."

T. Thomson Flynn's recent work on the placenta in *Perameles* (1923), in which the genus is stated to be "a most primitive form" in this respect (p. 173), must be noted here.

Notoryctidæ.—The description of *Notoryctes caurinus*, by Oldfield Thomas in 1920, from Wollal, North-west Australia, makes an interesting northern extension of this curious marsupial, which is evidently a "specialised dasyurid."

Diprotodontia.—It is of interest to note a few of the more recent records for existing diprotodont marsupials. Taking the *Phalangeridæ* first, we find that no less than twelve out of twenty species of *Pseudochirus* occur in Papua, whilst the remaining Australian species are so richly represented in the north that the dominance of the genus there is undoubted. *Dactylopsila* (with eight species), *Dactylonax* and *Distœchurus* are distinctly Papuan genera, whilst *Acrobates*, *Petaurus*, *Eudromicia* (Mjöberg, 1915), and *Dromicia* are represented. *Phalanger*, including *Ceonix* and *Wyulda* (Alexander, 1918) has a remarkable distribution, ranging from Celebes to San Christoval in the Solomon Islands, from Talaut through the Moluccas, Timor, Papua, and New Britain, the Arus to North Queensland and North-west Australia, with twelve species. This wide-spread distribution affords striking evidence of northern marsupial extension, especially in view of the fact, mentioned by Guppy (1887), that cuscus are preyed upon by dogs which attack them when they descend at nightfall. The genera of the *Phalangeridæ* are thus seen to be overwhelmingly represented in northern regions.

Of the macropods, *Dendrolagus*, *Dorcopsis*, and *Dorcopsulus* are obviously Papuan. *Hypsiprymnodon*, an annectant type, is confined to North Queensland. The genera *Petrogale*, *Lagorchestes*, *Epyprymnus*, and *Onychogale* are represented in the northern State. *Macopus* has a still wider range to Papua, New Britain,

and the Aru Islands, but it seems clear that the evolution of the characteristic saltatorial forms, represented by this genus, has taken place mainly in the plains and forests of the Australian mainland. But, as in other families, the majority of the macropodian genera are to be found in the Torresian region.

When fossil representatives are considered, species of *Phascolomys* are more numerous represented in northern than in southern Australia.

Tasmanian Fauna.—With the possible exception of *Wynyardia bassiana* Spencer, dealt with elsewhere, the marsupial fauna of Tasmania presents no species, neither living nor fossil, that cannot be readily conceived as derivable from mainland forms. With the palæontological evidence for *Sarcophilus* and *Thylacinus* in Queensland, this is surely clear. In the list published by Clive E. Lord in 1918, twenty species are mentioned. Of these, one, *Petaurus breviceps*, is an artificial introduction from the mainland; there are three varieties of mainland forms (*Trichosurus vulpecula* var. *fuliginosus*, *Macropus ruficollis* var. *bennetti* and *M. giganteus* var. *fuliginosus*); no less than ten are found on the mainland (*Sminthopsis leucopus*, *Phascogale swainsoni*, *Dasyurus viverrinus*, *D. maculatus*, *Perameles gunni*, *P. obesula*, *Petaurus breviceps*, *Dromicia nana*, *Potorous tridactylus*, and *Macropus billardieri*); the remaining seven are confined to Tasmania (*Phascogale minima*, *Sarcophilus ursinus*, *Thylacinus cynocephalus*, *Phascolomys ursinus*, *Pseudochirus* "cooki," *Dromicia lepida*, and *Bettongia cuniculus*). The present evidence of the marsupial fauna of Tasmania is decidedly in favour of the northern and not the southern origin of the group.

Syndactylism.—In 1923 Wood Jones analysed the relative age values of dental and pedal characters in classifying marsupials. After pointing out that the primitive marsupials were undoubtedly polyprotodont and didactylous, he shows that syndactylism must be a more primitive feature than diprotodontism because it is common to both groups; from a polyprotodont stock a syndactylous section arose which split up into the diprotodont group of herbivorous marsupials, on the one hand, and into the polyprotodont peramelids, on the other, the still more primitive didactylous dasyurids remaining unchanged. As it seems most improbable that this distinctive syndactylism could have been independently acquired, it is almost certain that this pedal character is one of greater antiquity than the specialised development of two front lower incisors, so characteristic of our dominant group. Syndactylism is thus a distinctive character of Australian marsupials, and it has apparently been developed here. It is absent in *Cænolestes* and in all other American marsupials, although in *Marmosa pusilla*, figured by Bensley (Plate VII, fig. 7), there is "an indication of the syndactylous condition of the Phalangeridæ" (p. 191). It is very doubtful, however, whether this approximation of the second and third digits in some species of *Marmosa* can be compared with the well-marked and dominant syndactylism of Australian groups. It is remarkable that in the illustration of *Marmosa pusilla* given by Oldfield Thomas (Pl. XXVIII, fig. 1) there is no trace of syndactylism. In specimens of *Marmosa mitis* (O. Bangs, 1898) in the Queensland Museum, examined by the writer, there is no evidence

of syndactylism, which does not appear to be even a specific character in the genus. The *M. pusilla* of the British Museum Catalogue is apparently referable to the nearly-allied *M. marica* O. Thomas, 1898.

Fossil Marsupials.—In tabulating evidence as to the origin of our marsupials, it is obvious that the index afforded by fossil genera and species is of even greater value than that of existing representatives. It appears to be an outstanding fact that *our fossil marsupial fauna is much more distinctively Australian than that of to-day*. We have ample evidence of gigantic specialised marsupials, such as *Diprotodon*, *Nototherium*, *Euryzygoma*, *Phascolonus*, *Sthenurus*, *Palorchestes*, *Procoptodon*, and *Thylacoleo*. There is no evidence whatever for the derivation of these specialised genera from either living or fossil American forms.

It is also very obvious that the genera existing to-day were much more richly represented in the past. The numerous species of *Macropus* (*sensu lato*) included very large forms, such as *M. anak*, whose trenchant premolar relatively dwarfs that of the Papuan *Dorcopsis*. The wombats of to-day are but a few survivors compared with their Pleistocene predecessors, which ranged from Clermont (Longman, 1917) to Western Australia. The carnivorous extinct *Thylacoleo carnifex* had for associates in Queensland species of *Sarcophilus* and *Thylacinus*, which were larger than Tasmanian species of to-day. A mandibular fragment of *Sarcophilus* was recorded from Rockhampton by the writer in 1921, this being an addition to the many records of the Queensland "devil" on the Darling Downs. The same species has been noted for Western Australia by L. Glauert, who has also recorded the following genera from his field:—*Diprotodon*, *Nototherium*, *Phascolonus*, *Phascolomys*, *Macropus*, *Sthenurus*, *Bettongia*, *Perameles*, *Thalacomys*, *Dasyurus*, *Thylacinus*, and *Thylacoleo*. Scott and Lord have published records in Tasmania of *Diprotodon*, *Nototherium*, *Palorchestes*, *Sthenurus*, and *Macropus*.

This wealth of widely spread fauna surely demonstrates that our marsupials have been long in the land. Bensley (1903, pp. 206-207) expressed the view that the lowest estimate of the duration of the evolution of the Australian marsupials is still much too large, and he thought it unlikely that "the marsupial radiation could have begun until well on into the middle of the Tertiary period." But Bensley's elaborate review dealt mainly with existing species, and he does not appear to have fully appreciated the wealth and divergencies of our fossil forms. It seems far more probable that Osgood is correct when he says (1921, p. 131) "the view that all living families of marsupials were well differentiated early in the Tertiary seems to be well founded." In the clash of conflicting views as to the age of marsupials in Australia, it is difficult to obtain a proper perspective. No one, however, can carefully examine a large and comprehensive collection of our fossils without recognising that they represent an assemblage resulting from a lengthy process of evolution, which, in the great majority of genera, cannot be associated with any forms yet found outside the Australian regions.

The many changes that have taken place in land masses of the Australian

region since Cretaceous times, as outlined by Jensen and others, cannot be dealt with here, but it is evident that a variety of environments was available for the evolution of our marsupials from remote ancestors which were northern in origin.

Myrmecoboides.—Special interest has been attached to the presence of *Myrmecoboides*, with supposed peramelid affinities in the Paleocene of Fort Union, North America. Gidley's notable work on this fragment (an incomplete ramus of a lower jaw) perforce deals mainly with dental characters. The resemblances to *Myrmecobius* are very suggestive, but are not conclusive, and may be the result of convergence. Gidley (1915) notes that the name *Myrmecoboides* was given on account of its likeness to *Myrmecobius* rather than as a positive assumption of real relationship. He does not accept Osborn's or Bensley's view concerning the phylogeny of modern families of marsupials, and assumes "a vastly more ancient origin" than has hitherto been held for them. He states: "In fact, it seems reasonable to assume that at present nothing is definitely known regarding the origin of several of the living families of marsupials, including probably all the diprotodonts, because they are not represented in our collections from beds older than the Pleistocene, and that in the lower fossils we have only an incomplete and indefinite history of the origin and development of a part only of the polyprotodonts" (p. 401).

Osgood (1921, p. 140) states: "The hypothesis can scarcely be avoided that, provided *Myrmecoboides* is a marsupial, it may well be ancestral to the cænolestids."

South American Fossils.—The Sparassodontia of Ameghino from the Miocene of Patagonia are placed by W. T. Sinclair in the Family Thylacinidæ. But it is significant that in *Borhyaena* the canine is actually replaced and in *Prothylacinus* the canine and two premolars are replaced. This marked tendency to a diphyodont dentition is unparalleled in Australian forms. Palatal vacuities and epipubic bones are lacking, and R. Lydekker, in 1907, in analysing these and other features, expressed the opinion that the Patagonian fossils were Creodonts and not marsupials. W. K. Gregory (1910, p. 207) states that these fossils show "a remarkable series of resemblances in general proportions and dental characters to some of the Creodonts among Placentals. . . . The family Thylacinidæ is thus seen to be a specialized offshoot either of very primitive Dasyuridæ or more directly from the Didelphiidæ."

Gidley (1915, p. 401) points out that in the Miocene the Thylacinidæ had reached almost their present state of specialization. They certainly do not represent a primitive type suggesting an ancestral source for Australian forms. Tate Regan (1914) adversely criticises the suggested relationship between the two groups.

It is by no means improbable that the resemblances between the Patagonian fossils and *Thylacinus* are due to convergence. But even if the lineal relationship were definitely proved, which Sinclair does not suggest, the South American origin of our Diprotodontia would still be without a satisfactory basis.

The position of the remarkable American marsupial *Cænolestes* has been

discussed in great detail by several authors, and it has been placed in no less than three sub-orders. Whilst many of its characters suggest that it may represent a prototypical generalized form, from the ancestors of which diprotodonts may have been derived, it seems to the writer that far weightier evidence is required before we associate the varied and manifold Diprotodontia of Australia with this marsupial from the Andes.

Among the many interesting points raised by Osgood in his elaborate memoir on *Cænolestes* is the fossil evidence that the diprotodont dentition of the cænolestid group goes back far in geological time, "perhaps in the Mesozoic," as the didelphids and cænolestids were already well distinguished in the Patagonian Miocene (Osgood, 1921, p. 129). Among his conclusions he states: "The ancestor of the cænolestids was probably a northern form which had already separated from the generalized polyprotodont stock. . . . The North American ancestor of the cænolestids possibly extended throughout Holarctica and therefore may also have given rise to the Australian diprotodonts. This assumes that the main lines of divergence between Diprotodonts and Polyprotodonts were established in the north prior to the Australian and South American radiations. Hence an Antarctic land connection is not necessary to explain the resemblances between American and Australian marsupials" (p. 151).

W. K. Gregory (1910) points out that the pes is "entirely eleuthero-dactylous," and he is inclined to regard *Cænolestes* and its allies as an independent sub-order, an offshoot of primitive Polyprotodonts, which has paralleled the Diprotodonts in certain characters of the dentition" (p. 211).

Gidley (1915, p. 401) states that the Cænolestidæ "more probably belongs with the Polyprotodonts."

In his analyses of the affinities of *Cænolestes* in 1911, R. Broom considers that it "was much more nearly allied to the American Polyprotodonts than to the Australian Diprotodonts" (p. 315).

Assuming that Wood Jones's argument for the special primitiveness of syndactylism is correct, the fact that modern cænolestids are diadactyl is an important point. It is also significant that a diprotodont dentition has independently appeared in several orders. It seems most probable that the resemblances between cænolestids and Australian diprotodonts are mainly due to convergence, but partly patterned by remote ancestral inheritance. There is now manifold evidence for the phenomena of convergence in obviously unrelated orders; it may be urged, *a fortiori*, that convergence is still more likely to appear in groups distantly related owing to the working out of similar ancestral potentialities.

Gregory (1910, pp. 212-213) writes: "Marsupials in general, and especially South American families of many orders, seem to abound in examples of homoplastic and convergent resemblances to animals of other orders."

Ameghino, who has described so many of the South American fossils, necessarily relies mainly on dental characters. In his phylogenetic diagram of

diprotodonts (1903, p. 188) he derives his *Hypsiptymnoidea* ("diprotodontes *australianos*") from the ancestral Garzonidæ through the primitive *Cænolestidæ*. After referring to the affinities of northern forms of Multituberculates with Patagonian fossils, he says: "Además, la transición entre los paucituberculados de la Argentina (*Epanorthidæ*, *Cænolestidæ*), y los diprotodontes actuales de Australia, es igualmente tan completa, que ya no es discutible la conclusión de que todos en conjunto constituyen un solo gran grupo." But the unitary grouping of the *Cænolestidæ* and *Diprotodontia* is not accepted by many authorities, and it seems a colossal assumption to derive the varied families and genera represented in Australia from the American species.

Wynyardia.—Baldwin Spencer's description of *Wynyardia bassiana* (1900) forms a notable contribution to the records of Australian vertebrate fossils. These remains, which have been attributed to the Eocene, were unaccompanied by teeth, but the describer instituted a large number of comparisons, based on available characters, and came to the conclusion that *Wynyardia* represented a form distinct from present marsupials, but allied to both existing *Polyprotodontia* and *Diprotodontia*. Osgood (1921) has criticised the diagnostic value of many of the characters set out by Spencer in his comprehensive analysis, but, whilst agreeing with the view that *Wynyardia* combines many features of the two groups, classifies it with the diprotodonts and makes it the type of a new family—*Wynyardiidae*. He then compares this fossil with *Cænolestes*, as suggested by Gregory in 1910.

It appears to the writer that *Wynyardia* has no real relationship with *Cænolestes*, and that the differences are far more marked than the eight resemblances noted by Osgood (p. 139). The proportions of the nasals and the slope of the sutures between premaxillæ and maxillæ, mentioned by him, are most variable in modern marsupials of the same genus, and are of no real diagnostic value.

Among the many distinctions between *Wynyardia* and *Cænolestes* which can be noted by comparing the two forms, I have drawn up the following, which seem to be significant:—

The squamosal is extremely large ("a very remarkable feature"—Spencer) in the Tasmanian fossil, and excludes the alisphenoid from union with the parietal, whilst in *Cænolestes* the alisphenoid has a wide union with the upper element.

The zygomata are massive in *Wynyardia* and set relatively high; in *Cænolestes* they are slender and are set low.

The lachrymal in *Wynyardia* is so well developed that it actually prevents contact between the maxillary and nasal bones, being in striking contrast to the American form.

The occipital regions in the two fossils are quite unlike.

So far as can be judged from the mandibular fragment of *Wynyardia*, it is utterly dissimilar from the lower jaw of *Cænolestes*.

The tibia of *Wynyardia* is of a very different type, and the fibula "is a complete separate bone."

It should be stated that Osgood recognised that his comparison between the two forms was "rather unsatisfactory as a basis for positive conclusions."

Osgood also compares *Wynyardia* with extinct American forms, *Palæothentes* and *Abderites*, allied to *Cænolestes*. One of the most remarkable features of the Tasmanian fossil is the presence in the incomplete ramus of the lower jaw of "a deep depression across the upper surface, which must apparently have been situated in the area occupied by the molar series. It extends in a slanting direction from side to side across the jaw, and its smooth, rounded floor-surface and margins show clearly that it is not a mere break in the jaw. With this is associated a swelling on the internal face. . . ." (Spencer, p. 784). The describer suggests that it may have been associated with the presence of a large sectorial tooth in the molar or premolar series such as is developed in *Abderites*. Gregory (1910, p. 215) instances an alveolar groove in Ameghino's *Garzonina minima*, and Osgood, in 1921, writes that the structure of the lower sectorial tooth in *Abderites* "seems closely comparable to the condition in *Wynyardia*." When Ameghino's figures of *Abderites meridionalis* and of *Garzonina minima* are consulted, it seems to the writer that there is no evidence whatever of relationship. In these American fossils we see no sign of the remarkable contours figured for *Wynyardia*. Assuming that the depression represents diastemata between molar series and incisors, then there is no similarity between the two groups of fossils. Should this smooth transverse furrow be interpreted as representing the site of a large sectorial tooth that had been accidentally lost long before the death of the animal, then comparisons for this special feature might quite as well be instituted between *Hypsiprymnodon* or even *Phalanger*, present Australian forms with prominent oblique premolars. To suggest a theory of relationship on the possible shape of a tooth that is not even represented by an alveolus is, however, far beyond the scope of this paper.

In the light of our present knowledge, there appears to be no valid reason for suggesting that *Wynyardia bassiana* is related to the cænolestids of South America.

Two fossils from eastern Australia are significant because they demonstrate combinations of characters. *Burramys parvus* from Taralga, N.S.W., described by R. Broom in 1895, has a large grooved premolar, and is probably an annectant form between the Macropodidae and Phalangeridae. *Triclis oscillans*, from King's Creek, Darling Downs, Queensland, has somewhat similar characters, and was compared by De Vis (1888) to the existing *Hypsiprymnodon*.

In 1916 W. D. Matthew described, under the name of *Eodelphis browni*, a primitive opossum from the upper Cretaceous of Alberta. Referring to this form, Gregory (1920, p. 156), in reviewing the early polyprotodont marsupials, says: "The more primitive members (*Eodelphis*) seem to be directly ancestral to

the modern Didelphiidæ of North and South America, and were also probably related to the Upper Cretaceous European and Asiatic polyprotodonts that were ancestral to the later Australian members of this group."

BRIEF NOTES ON THE NON-MARSUPIAL FAUNA.

Monotremes.—The absence of monotremes from South America and their special development in Australia is evidence of their northern origin, probably in pre-Tertiary times. The development of *Zaglossus* and *Prozaglossus* (Kerbert, 1913) in Papua is significant. Pliocene monotremes have been recorded by W. S. Dun (1895) from New South Wales. Species of *Zaglossus* have also been recorded by L. Glauert from West Australian deposits, and by Scott and Lord from Tasmania. Two genera are represented in Darling Downs deposits.

Rodentia.—The evidence of other mammals is distinctly favourable to the hypothesis of lengthy and extensive northern land connections. In 1916 the writer remarked on the significance of about fifty autochthonous species of rodents in Australia and Tasmania. Since then the list has considerably increased. So far as I am aware, no alternative to a northern origin of the ancestors of these rodents has ever been suggested.

Reptilia.—With regard to the reptilian fauna, Thomas Barbour, in his valuable study of the Zoogeography of the East Indian Islands (1912) states: "The remarkable development of Ophidia proteroglypha in Australia can hardly be explained by assuming that they came from South America." He holds, on the contrary, that they originated in Asia and spread through Australia to South America (p. 155). He refers elsewhere to the strong Australian and perhaps a Papuan tinge in the fauna of Timor, instancing *Chelodina* and *Liasis*.

If we eliminate such genera as *Typhlops* and *Natrix*, which are cosmopolitan and presumably palæogenic forms, we find that the affinities of our ophidian fauna are certainly not with America. There are no true pythons in America, and our genera of constricting snakes are evidently northern in origin. Of the Acrochordinæ, *Acrochordus* and *Chersydrus* are northern, and this also applies to the genera of Homalopsinæ and to *Dendrophis*. Compared with the rich development of Elapine snakes in Asia, Africa, and Australia, this group is sparsely represented in America. The Hydrophiinæ have special means of distribution, but if they are entitled to consideration they tell the same story. The paramount affinities of the Australian snakes as a whole are undeniably northern.

Many species of Ophidia, Lacertilia, and Chelonina are common to North Queensland and Papua.

Of the Lacertilia, the Geckonidæ and Scincidæ are so cosmopolitan that no special significance can be attached to their distribution, although Australia has such distinctive genera as *Nephrurus* and *Trachysaurus*, to mention but two. The Pygopodidæ are confined to Australia and Papua. The Agamidæ and

Varanidæ are African, Asiatic, and Australian in range. There are no Iguanidæ in our region. The lacertilian fauna affords no evidence whatever for an American invasion, and its affinities are decidedly northern.

Amphibia.—Much has been made of the presence of Cystignathidæ in America and in Australia, but it seems exceedingly doubtful whether the many genera of frogs placed in this family in these regions constitute a natural assemblage. Gadow writes: "The numerous genera not only run into each other, but also get entangled with those of other families. In fact the whole family is ill defined." (1909, p. 209). Amongst the amphibians the phenomena of convergence are very well known.

Van Kampen has pointed out that many Indian forms of Amphibia must have reached Papua by ancient land connections (1909).

Fishes.—The evidence of certain fresh-water fishes (Galaxiidæ and Aplochitonidæ) found in Australia, New Zealand, and South America has been repeatedly stressed by the exponents of the Antarctic connection. Tate Regan, however, insists that these are of marine origin (1914) and A. R. McCulloch (1915) actually discovered young specimens of *Galaxias attenuatus* making their way from the coast into fresh water. Regan (*loc. cit.*) points out that the only true fresh-water fishes common to these regions are the Osteoglossidæ, and that our well-known representative of this ancient group (the Barramundi, *Scleropages leichhardti*) has greater affinities with Asiatic forms. He concludes that "neither marine nor fresh-water fishes support the theory that the Antarctic continent connected America with Australia during the Tertiary Period." (p. 41).

Max Weber and de Beaufort have found an Australian element in the fresh-water fishes of the Aru Islands and Waigen, and an interesting summary of their views appears in "The Zoology of the Indo-Australian Archipelago" (1923.)

Flora.—The present endemic nature of the great bulk of the Australian fauna is borne out by the testimony of the flora. The "original Australian flora" (to use Maiden's term) is the dominant group on the western side, where it apparently developed. On the east, however, the Austro-Malayan element is the more prominent, and one may reasonably suggest that only an unfavourable environment prevented its extension into temperate regions towards the south and cretaceous regions to the west. There appears to be no absolute need to postulate a land bridge, suitable for emigrating mammals, with South America to account for the third, or so-called Antarctic element.

The writer is in no way competent to comment on the geological evidence, but, judging from R. N. R. Brown's review of the problems of Antarctica (1923), further exploration is needed before the relationships of the eastern and western portions can be made clear. W. N. Benson, in his able study of Palæozoic and Mesozoic seas in Australasia, gives strong evidence of the land connection of Australasia with Antarctica and South America at the close of Mesozoic

times, but it must be noted that, at the same time, there were land connections to the north and north-east linking Australia with the remains of the ancient continent called *Æquinoctia*, by E. C. Abendanon (1919, p. 577). Similar northern extensions are a salient feature of Hedley's map, published in 1909 (p. 333). The probable extent of this northern continental mass, as it may have existed in early Mesozoic times, is shown by A. B. Walkom (1918, text-figure 2, p. 105). The shallow submarine plateau connecting Australia with Papua, the Aru, and some other islands is called "the Sahul flat" by Molengraaf.

There is some diversity of opinion as to the age of the connections denoted by the great shelves in what Molengraaf calls "the Australasian Mediterranean" (1921), and it is not improbable on zoological evidence that the first connections may have been long anterior to the relatively recent variations, which may have been indirectly effected by glacial and interglacial periods.

Valuable references to the views of authorities on the relationships of the Asiatic and Australian faunas are given in "The Zoology of the Indo-Australian Archipelago" (1923); whilst Chilton (1909) gives an interesting summary of the relationships of circum-austral forms from the New Zealand standpoint.

The assumption of a continent in the Antarctic in early Tertiary times, in order to account for related elements in the faunas and floras of South America, Australia, New Zealand, various Pacific Islands, Madagascar, and South Africa, has proved a veritable Pandora's box to biologists. In order to explain many of the difficulties raised, it is suggested that this circumpolar area had radiating land bridges, inconstant in direction and dimension, apparently reaching out on the one hand to deposit certain types in Pacific archipelagoes; elsewhere stretching to Madagascar to transfer iguanas; extending to New Zealand to allow other forms to gain new land; and independently reaching Tasmania to enable the ancestors of our marsupials to complete a trans-polar journey and find a congenial refuge.

The presence of more extensive land areas in the Antarctic in Mesozoic times is apparently demonstrated, but it seems improbable that these areas were faunal land bridges for vertebrates. On the other hand, the presence of "ancient continental" islands to the north-west, as shown by Russel Wallace in "Island Life" and the "Geographical Distribution of Animals," is undoubted. That the evidence of these "ancient continental" islands is incomplete is doubtless due to partial or entire submergence. In this connection it is interesting to note that Weber and Beaufort (1912) in their analysis of the fresh-water fishes of Timor found that this fish fauna was "almost totally composed of immigrants from the sea," the inference being that the island had been largely submerged in Tertiary times.

Possibly fossils from the Austro-Malayan-Asiatic regions will one day be forthcoming to strengthen the view that our marsupials had a northern origin probably before "Wallace's Line" had significance as a partial barrier. But even on existing evidence, it seems to the writer that the alternative route of Antarctic land bridges involves us in far greater difficulties and anomalies.

CONCLUSIONS.

A fundamental consideration regarding the origin of Australian marsupials is the undoubted fact that the group was once widely distributed in Holarctic or northern regions.

A second consideration is the present-day knowledge that North Australia and Papua maintain a wealth of diverse marsupial genera, the significance of which could not be realised in earlier discussions.

A third consideration is the demonstration that our extinct marsupial fauna was even more distinctly Australian than that of to-day; the evolution of the group has largely taken place here.

A fourth consideration is that the differences between *Wynyardia bassiana*, our oldest marsupial fossil, and the South American Cænolestids far outweigh the resemblances.

A fifth consideration is that the most characteristic group of Australian marsupials, the Diprotodontia, has little or nothing in common with South American forms; the slight resemblance between *Cænolestes* and our diprotodonts is probably due to convergence.

A sixth consideration is the demonstration by Osgood that "didelphids and cænolestids were already well distinguished in the Patagonian Miocene," and that "the view that all the living families of marsupials were well differentiated early in the Tertiary seems to be well founded" (p. 131).

A seventh consideration is the rich development of the primitive family Peramelidæ in the Austro-Malayan region.

An eighth consideration is that distinctive syndactylism is a special Australian feature; Wood Jones has analysed the alternative values of dental and pedal characters, demonstrating that syndactylism is the more primitive feature.

These and other considerations are supported by evidence, briefly outlined in this paper, dealing with the probable relationships of several non-marsupial groups (monotremes, rodents, etc.) of the Australian fauna, and the work of zoogeographers on the Indo-Australian Archipelago is considered of special importance.

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SOME QUEENSLAND FOSSIL VERTEBRATES.

BY HEBER A. LONGMAN, F.L.S., DIRECTOR, QUEENSLAND MUSEUM.

(Plates I.-IV.)

Introduction.—This paper contains descriptions of a new genus of Cretaceous marine reptiles from Hughenden, and a new species of crocodile from alluvial deposits at Tara Creek. A new generic name is proposed for *Triclis* De Vis (preoccupied). The status of several species of Queensland fossil vertebrates is discussed in the light of new or revised material, and a record is made of a series of remains from the Marmor Quarry.

DIPROTODON AUSTRALIS Owen.

Four specific names have been given to remains of *Diprotodon* from Australia. Owen's *D. australis* was first described in 1838.¹ *Diprotodon minor* was differentiated by Huxley in 1862², and in 1888 De Vis³ further particularised this species. *Diprotodon longiceps* was described by McCoy in 1876, from the "Pliocene Clays of Colac," his cranial material showing, when compared with *D. australis*, a more slender or comparatively elongate head, and with longer and straighter lower incisors.⁴ In 1877 Owen gave the name "*Diprotodon bennettii*" to an incomplete right mandibular ramus from Mandoona, N.S. Wales, as "an established variety or species of *Diprotodon*" (p. 510) which was also of a more slender type than *D. australis*.⁵ This specimen, No. 46056, was subsequently included by Lydekker in *D. australis*.⁶ Stirling and Zietz,⁷ in their review of the Callabonna material, point out that there are numerous remains that give evidence of "a relatively small-sized *Diprotodon*," the differences between it and the larger forms being "mainly one of size." Although these authors consider the difference of bulk to be too great to be probably due to sexual characters, they do not altogether dismiss this possibility.

The largest cranium of *D. australis* in the Queensland Museum is 3 ft. 1½ in. in maximum length, but judging from the proportions of certain fragments in our collections it seems probable that some specimens of *Diprotodon* had skulls at least 3 ft. 6 in. long. The breadth of an anterior upper incisor may be as great as 60 mm. The lower incisors may exceed a foot in length;

¹ Owen, R., in Mitchell's "Three Expeditions into Eastern Australia, 1838, Vol. II., p. 362.

² Huxley, T. H., Quart. Journ. Geol. Soc., XVIII., 1862, pp. 422-427.

³ De Vis, C. W., Proc. Roy. Soc. Qld., V., 1888, pp. 38-44.

⁴ McCoy, F., Prod. Pal. Victoria, Dec. IV., 1876.

⁵ Owen, R., Extinct Mammals Austr., 1877, p. 510.

⁶ Lydekker, R., Catal. Foss. Mamm. Brit. Mus., V., 1877, p. 176.

⁷ Stirling & Zietz, Mem. Roy. Soc. South Aus., I., 1899.



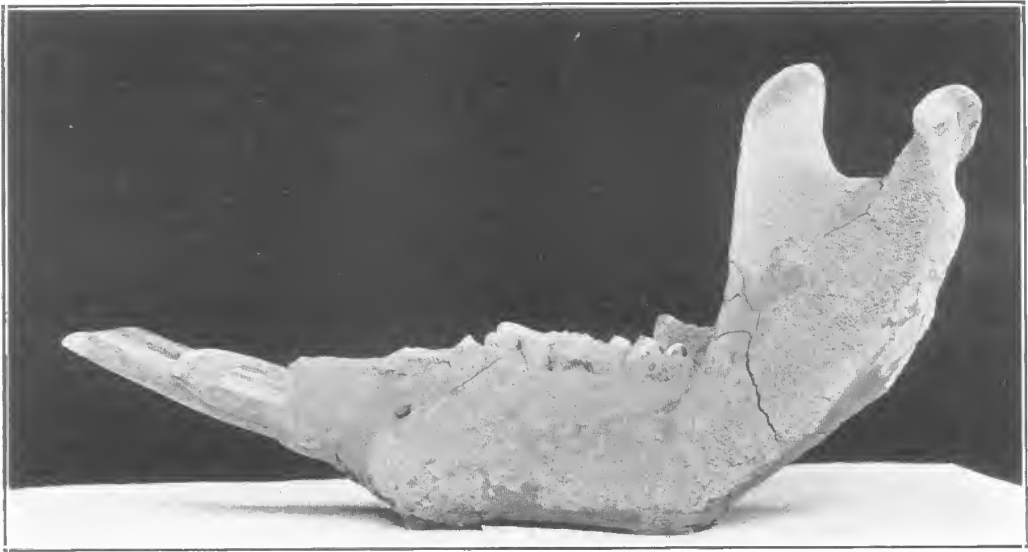


Fig. 1.—Mandible of *Diprotodon australis* Owen, with broken incisor.
Maximum length 702 mm.

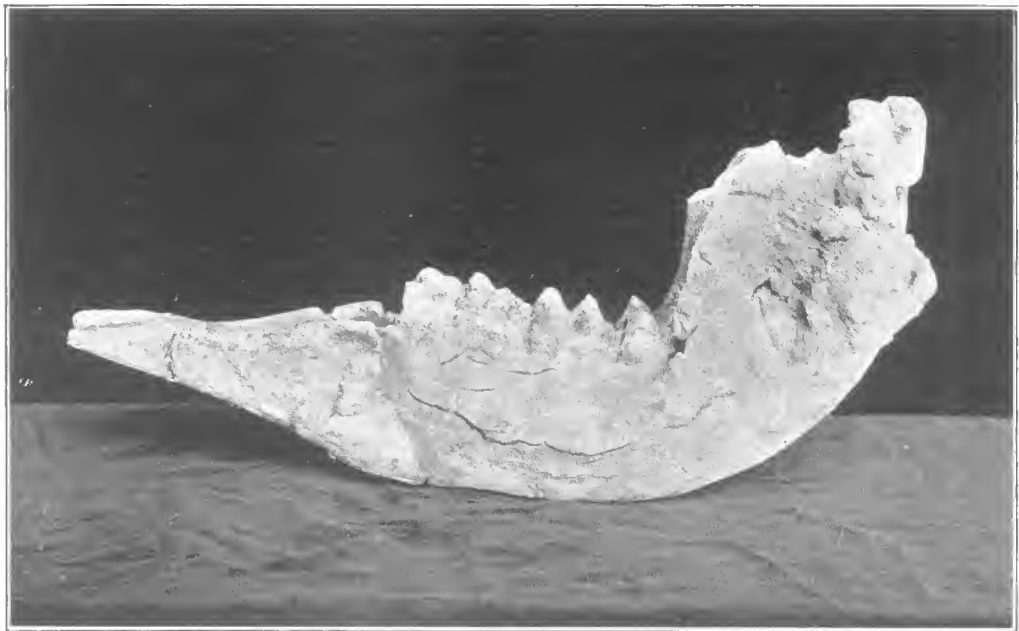


Fig. 2.—Mandible of *Diprotodon minor* Huxley. Maximum length 535 mm.

McCoy mentioned $13\frac{1}{2}$ in. for his *D. longiceps*. These incisors, however, are most variable. In a juvenile specimen the length of the protruding part may be about equal to the antero-posterior diameter of a single molar, but in aged specimens it may more than exceed that of three molars. Probably the variation in mature specimens is partly attributable to sex characteristics, but it seems almost certain that there were two distinct species.

In October, 1922, Mr. Thomas Jack, of Dalby, forwarded to the Queensland Museum a number of remains, including fairly complete associated specimens of a right tibia, fibula, astragalus, calcaneum, and other pedal bones, together with the distal end of a femur of *Diprotodon australis*, which had been found in Jimbour Creek, Darling Downs. These fossils are remarkable for their unusual size. The maximum width, taken between vertical parallels, of the condyles of the femur is no less than 236 mm. The width of a complete femur on exhibition is 196 mm. in this region, and this bone is 745 mm. in maximum length. Although the proportions of the massive structure of the articular region are not likely to be fully represented in total length ratios, it is obvious that Mr. Jack's specimens demonstrate a very large *Diprotodon*.

A fairly complete mandible of *Diprotodon australis*, sent in by the late Mr. N. Pearson, from Nobby, Darling Downs, in April, 1913, is of interest because one of its incisors bears undoubted evidence of a complete fracture during life which doomed the animal to complete the remainder of its existence with a shortened tusk. As may be seen from Plate I., fig. 1, about one-third of the left incisor is missing. That this incident took place some time before death is obvious, for the fractured part has become relatively smooth on its exposed surfaces, though signs of the trouble are still noticeable in its irregular outlines. A splinter is also missing from the lateral surface near to the apex of the right incisor, and this area has been smoothed over. Whether the individual was a bellicose male who suffered as the result of conflict with his fellows, or perchance even because of domestic troubles, it is difficult to surmise, and the accident may have been the result of a clumsy fall. In view of the evidence recorded by Sterling and Zietz that *Diprotodons* fed on low shrubs (*Salsolacæ*, *Amarantacæ*, etc.), as deduced by palæobotanists from associated remains, it seems unlikely that the giant marsupial sustained an accident when attempting to reach arboreal food, and its pedal structure almost precludes this possibility. But whatever the cause, this fractured tusk demonstrates that peace was not the invariable portion of these huge herbivores in bygone days.

DIPROTODON MINOR Huxley.

Among the numerous fragments attributed to *Diprotodon* in the Queensland Museum there are several specimens tentatively classed as *D. minor*. The most interesting of these is a fairly complete though much-crushed cranium, with mandible and a number of associated bones, received from the Darling Downs in 1909, the donor being Mr. Charles Campbell, Surveyor. The cranium has

been obliquely compressed, yet the process must have taken place very gradually, for even the slender zygomatics are not badly fractured. The molar series with the premolar is complete on each side. Although the wear manifested by the molars does not suggest the maximum of growth, the maturity of the individual is demonstrated by the fact that the hind lobes of both fourth molars have complete loops of dentine exposed, these being 5.5 mm. in antero-posterior diameter.

As it seems desirable to put on record data bearing on the question of a second species, the following dimensions are given:—

Maximum length of cranium from condyles to anterior						
edge of incisors .. .. .	..	..	..	..	..	670
Diastema .. .. .	..	..	..	..	..	119
Width of anterior incisor at emergence from alveolus	..	..	..	..	..	42
Antero-posterior diameter of molar series with p.m. ⁴						
right .. .. .	..	..	..	..	..	207
Antero-posterior diameter of molar series with p.m. ⁴						
left .. .. .	..	..	..	..	..	202
Width of m ¹ , anterior lobe .. .. .	..	..	..	..	..	32
Width of m ² , anterior lobe .. .. .	..	..	..	..	..	41
Width of m ³ , anterior lobe .. .. .	..	..	..	..	..	48
Width of m ⁴ , anterior lobe .. .. .	..	..	..	..	..	48
Width of m ⁴ , posterior lobe .. .. .	..	..	..	..	..	38.5

Owing to inequalities of wear in the premolars, satisfactory comparisons cannot be made between the features of these teeth in *D. australis* and *minor* as set out by Huxley and supplemented by De Vis. The measurements of the true molars are, on the whole, larger than those given for *D. minor* by Huxley. The lower jaw has a maximum length between verticals of 535 mm. The incisors are relatively small and do not protrude from their alveoli more than 90 mm. on the superior surface. No premolars are present.

In this specimen the distinctive features of *D. minor* as mentioned by De Vis (1888, p. 42) are present in the region of the mandibular symphysis. It must be added, however, that in some of our fragments the dimensions of the molar teeth in small mandibles are equal to those in very bulky jaws. Elongate and presumably male incisors are occasionally to be found in slender jaws of the *minor* type.

Although the evidence is not quite conclusive, a distinction between the two forms may be conveniently set out as follows:—

- Mandibular symphysis broad at base of incisive sockets ;
 antero-inferior border terminating in an abrupt
 upward curve *Diprotodon australis*.
 - Mandibular symphysis relatively narrow at base of
 incisive sockets ; antero-inferior border sloping
 gradually to the plane of the incisors *Diprotodon minor*.
- Four specimens illustrating these differences are shown on Plates I. and II.



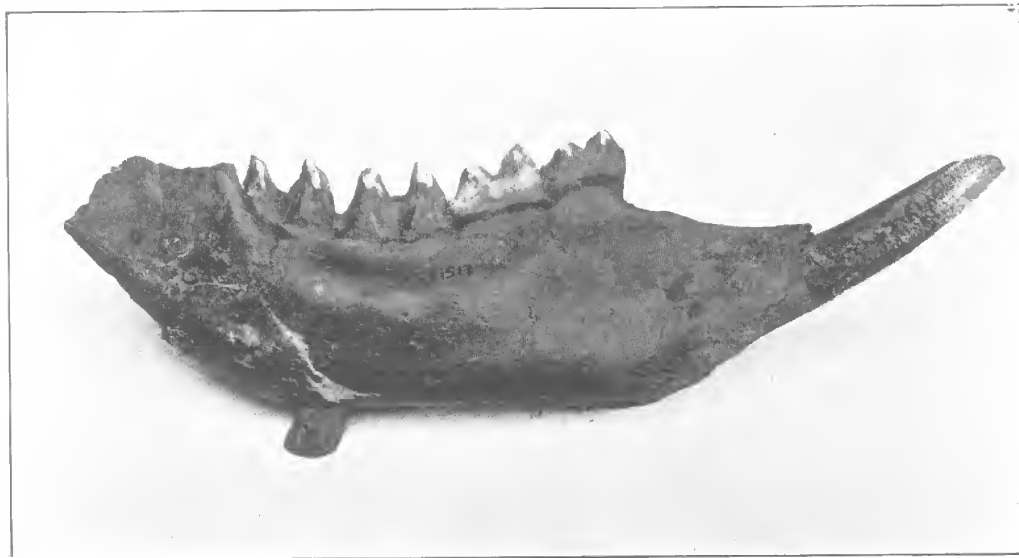


Fig. 1.—Incomplete mandible of *Diprotodon minor* Huxley. Maximum length 384 mm.



Fig. 2.—Incomplete mandible of juvenile *Diprotodon australis* Owen. Maximum length 212 mm.



Figs. 3 and 4.—Incisor of *Phascalomys magnus*.

In passing, it may be noted that a present-day parallel for the existence of two associated species, mainly differing in size, is afforded by *Macropus giganteus* and *M. melanops*, the specific distinction of the latter having been recently affirmed by A. S. Le Souef.⁸

EURYZYGOMA DUNENSE (De Vis).⁹

In October last Mr. Thomas Jack donated an exceptionally well-preserved fragment of the above species, which had been secured in a well at Ehlma Siding, near Brigalow, at a depth of sixty-five feet. The specimen consists of a portion of the right maxilla with the first three true molars. Part of the zygomatic process is present, and the peculiar structure of this region (associated with the enormous development of the infero-lateral processes as described by the writer in 1921)¹⁰ at once shows the relationship of the fossil with this very distinct form.

PHASCOLONUS GIGAS Owen.

In 1913 the late Sir Edward Sterling was able to demonstrate beyond doubt the association of the remarkable curved scalpriform teeth, previously known as *Sceparnodon ramsayi* Owen, with the molars of *Phascolonus*, and the distinction of this genus from the ordinary wombats.¹¹ This was made possible by the fine associated material found at Lake Callabonna and Normanville. As some controversy had arisen over the status of the incisor teeth, previously in doubt, and as De Vis had advanced other views and figured three kinds of teeth, it is advisable to review the specimens in the light of our fuller knowledge.

In passing, it may be said that the astonishing variety manifested in the dentition of our fossil marsupials is sufficient explanation, if such be needed, for the views advanced by De Vis when dealing with isolated teeth or very inadequate material. In the opinion of the writer the tooth figured by De Vis (1891, Plate XXII.) as a right lower incisor is a left upper incisor.¹² This is evidently a tooth from an immature individual, and it may be compared with that figured by Sterling (1913) in Plate XLV., fig. 6. The minimum width of this tooth is 16 mm. and the maximum at the incomplete radical end is 21. Apparently the young teeth are tapering, but the adult incisors may be parallel-sided and as much as 40 mm. in width. W. S. Dun's study of these teeth in 1894 affords other instances of variation.¹³

In 1893 De Vis published¹⁴ a description of a maxillary fragment and also figured (Plate I.) a large incisor purported to be a right upper incisor of

⁸ Le Souef, A. S., Austr. Zool., III., 1923, pp. 145-147.

⁹ De Vis., C. W., Proc. Linn. Soc. N.S.W., II. (2), 1887, pp. 1065-1070.

¹⁰ Longman, H. A., Mem. Qld. Mus., VII., pt. 2, 1921, pp. 65-80.

¹¹ Sterling, E. C., Mem. Roy. Soc. S. Aus., I., 1913, pp. 111-178.

¹² De Vis, C. W., Proc. Linn. Soc. N.S.W., (2) VI., 1891, pp. 258-262.

¹³ Dun, W. S., Rec. Geol. Surv. N.S.W., III., 1892, pp. 25-28.

¹⁴ De Vis, C. W., Proc. Linn. Soc. N.S.W., VIII. (2), 1893, pp. 11-12.

Phascolonus gigas. It is somewhat surprising to find that this isolated tooth agrees in detail with left lower incisors of *Euryzygoma* (*Nototherium*) *dunense*, of which there are now mature examples *in situ* in mandibles probably not available to De Vis in 1893. In sculpturing and dimensions these incisors agree admirably.

PHASCOLOMYS MAGNUS Owen.

(Plate II., figs. 3 and 4.)

A left upper sub-circular incisor of the *Phascolomys curvirostris* type from Gowrie Creek, Darling Downs, has been identified with *Phascolomys magnus*, with some little hesitation, as no anterior teeth have been previously associated with this species. Its dimensions are larger than those of a cast of the type of *P. curvirostris*, and the curve is greater. Following the upper surface of the arc, this tooth, which is almost perfect, is 176 mm. in length. The maximum breadth is 17 mm.; the antero-posterior diameter is 12.5 and the working surface is 26 mm. in extent. The dimensions are fairly regular throughout, and the tooth is but slightly smaller towards the apex. The inner side of this incisor is not flattened, but uniformly convex. The superior and lateral surfaces are clothed with slightly rugose enamel, and throughout the entire length there are fine but distinct parallel flutings. On the outer part of the ventral surface there is a shallow channel, but, with this exception, a section of the tooth shows even curves. A prominent pulp cavity is seen at the radical end, although this is infilled with fine debris.

In response to my inquiry, Dr. C. Anderson, Director of the Australian Museum, informs me that the type specimen of *Phascolomys curvirostris* is not in their collection, notwithstanding Lydekker's remarks,¹⁵ so further comparison cannot be instituted. The writer suggests, however, that incisors of the *curvirostris* type will some day be found in association with molars of *Phascolomys medius*, and the anterior and posterior dental elements of these large wombats will then be fully elucidated.

PROPLEOPUS, new generic name.

PROPLEOPUS OSCILLANS (De Vis), 1888.¹⁶

Owing to the preoccupation of *Triclis* De Vis (1888) by *Triclis* Loew. (1831), the interesting mandible described by the Queensland palæontologist as *T. oscillans* requires a new generic name. De Vis rightly regarded this fragment as having paramount affinities with *Hypsiprymnodon*¹⁷, and it seems appropriate to utilise Owen's name *Pleopus* (given a year later than Ramsay's),¹⁸ with a prefix denoting antiquity, for this fossil. The affinities exhibited by the dental characters are so definite that they may have been associated with similar

¹⁵ Lydekker, R. Catal. Foss. Mamm. V., 1887, p. 152.

¹⁶ De Vis, C. W., Proc. Linn. Soc. N.S.W., III. (2), 1888, pp. 5-8.

¹⁷ Ramsay, E. P., Proc. Linn. Soc. N.S.W., I., 1876, p. 4.

¹⁸ Owen, R., Ann. Mag. N.H. XX. (4), 1877, p. 542.

pedal structures, but this assumption cannot be verified. As De Vis in his original description used the term *Pleopodidæ* to embrace what he considered to be the more generalised *Triclis* and the specialised *Hypsiprymnodon*, the new name, *Propleopus*, may be deemed applicable on these grounds.

MARMOR QUARRY FOSSILS.

Through the interest and enthusiasm of Mr. Samuel Evans, J.P., of the Limestone Quarry at Marmor, on the North Coast line, 24 miles south of Rockhampton, several consignments of fossil bones have been received during the last few years.

Unfortunately most of the specimens are very fragmentary, so much so that it is deemed inadvisable, on the present material, to give specific names to several. The list is as follows:—

Thylacoleo carnifex Owen.—Incomplete lower carnassial from the right-hand side; the cutting edge is but little worn; also a calcaneum. It is interesting to be able to add another locality for this remarkable marsupial, which was received through Mr. L. C. Ball.

Trichosurus sp.—Incomplete left mandible. With the exception of the third true molar the crowns of the teeth are missing. Closely comparable with large specimens of the existing *T. vulpecula*.

Diprotodon australis Owen.—Incomplete molar tooth and remains of a vertebra.

Phascolomys sp.—Abraded teeth, including one complete molar, evidently representing a large species, closely comparable with *P. mitchelli*.

Macropus sp.—Remains of molar series which are probably identical with *M. ualabatus*.

Macropus anak Owen.—Fragments of molars of this large extinct kangaroo, which is commonly represented in our Darling Downs material.

Megalia prisca Owen¹⁹.—A single vertebra, somewhat abraded, presents evidence of this gigantic lizard. The presence of facets for chevron bones shows that it belonged to the caudal series. The maximum antero-posterior diameter of the specimen is 37.5 mm., and the diameters of the cup are 18 and 11 mm. The small dimensions suggest a unit from the posterior portion of the tail.

Baron G. J. de Fejérváry²⁰ has emphasised what he considers a special development of the zygtrum and zygosphenæ in the Megalian vertebrae as compared with *Varanus* in his interesting review of the group, and he has established the family Megalanidæ. Lydekker²¹ compared the vertebrae of *Megalia* with those of *Varanus sivalensis*, stating that they agree in general

¹⁹ Owen, R., Phil. Trans. Roy. Soc., Vol. 149, 1860, pp. 43-48.

²⁰ Fejérváry, Baron G. J. de., Ann. Mus. Nat. Hungarici, XVI., 1918, pp. 341-467.

²¹ Lydekker, R., Catal. Foss. Rept. Amph. B.M., 1888, Pt. 1, p. 284.

character. There is considerable variation in size and characteristics associated with the vertebræ of present-day species of *Varanus*, and it seems doubtful whether *Megalanía prisca* is entitled to special distinction on these grounds from the Monitors.

In the opinion of the writer it is quite incorrect to interpret the vertebræ of *Megalanía prisca* as possessing "a strongly developed zygosphen and zygantrum." When a comparison is made between the Megalanian vertebræ and those of reptiles in which the complex articulation of a zygosphen and zygantrum is present in addition to the lateral and more normal facets, such as in *Iguana* or in *Python*, it is obvious that Baron Fejérváry is mistaken in his nomenclature. In *Megalanía* the central portion of the neural arch carrying the postzygapophyses is not recessed as a zygantrum, and the supposed zygosphen of Baron Fejérváry is not present between the prezygapophyses. The normal concavities on either side of the median line on the posterior aspect of the neural arch should not be interpreted as a zygantrum. The supposed zygosphen of Baron Fejérváry is merely a small and irregular area above the neural canal on the anterior side and which, in some specimens, may have small lateral tubercles, as recorded by Owen (1881, p. 1038)²², but which is mainly composed of the anterior ridge of the neural spine. This area varies considerably in its development in different vertebræ, but is never very prominent, and in some specimens is entirely lacking. (Parenthetically, it may be noted that the anterior ridge of the neural spine may be strongly developed in vertebræ of Australian species of *Varanus* to-day.) When two Megalanian vertebræ are closely approximated, it will be seen that these small and variable structures could not have functioned as articulating facets. To refer to them as "a strongly developed zygosphen and zygantrum" is contradictory. It is correct to interpret the articular facets of *Megalanía* as strongly developed pre- and post-zygapophyses, and in this respect they differ only in size from the vertebræ of present-day Australian species of *Varanus*.

In 1890 De Vis²³ tentatively expressed the opinion that *Megalanía prisca* and *Notiosaurus dentatus* were identical, and this was also stated on our labelled specimens. This contention was subsequently confirmed by R. Etheridge²⁴.

Included among the other specimens forwarded by Mr. Evans were the mandible of a rat, with molars larger than those of *Rattus norvegicus*, and the humerus of a bat which is identical with that of *Megaderma gigas*.

It is almost certain that the specimens forwarded by Mr. Evans represent distinct periods of deposition.

²² Owen, R., Phil. Trans. Roy. Soc., Vol. 171, 1881, p. 1038.

²³ De Vis, C. W., Proc. Roy. Soc. Qld., II., 1885, p. 25, and VI., 1890, p. 97.

²⁴ Etheridge, R., Proc. Roy. Soc. Vict., XXIX, (2), 1917, p. 127.

NOTE BY MR. L. C. BALL.

Mr. L. C. Ball, Government Geologist, has kindly given me the following notes on the Marmor Limestone Quarry :—"The Mount Morgan Company's quarries have been excavated in a high bluff of Devonian limestone overlooking the township of Marmor, on the North Coast Railway. Some idea of the size of the quarries may be gained from the knowledge that for long periods the shipments amounted to 2,700 tons per week. The rock as a whole is remarkably free from caverns, and it is believed that the bone earth collected by Mr. Evans came from a joint opening and not from a solution cave. I have not yet had an opportunity to investigate the occurrence."

Mr. Ball describes the matrix as an indurated, bone-bearing cave-earth, which is essentially carbonate of lime, with a brownish stain due to the presence of hydroxides of iron.

REPTILIAN REMAINS FROM TARA CREEK.

The Queensland Museum is indebted to Sir Matthew Nathan, Governor of Queensland, for numerous specimens, and in September last the writer received from him a parcel of fossil fragments which had been collected by Mr. J. R. Chisholm from the head of Tara Creek, a tributary of the Clarke River, by Maryvale Creek, North Queensland, over one hundred miles inland from Townsville. The fragments represent *Chelodina insculpta* De Vis (1897), and a new species of crocodile, which has been named *Crocodylus Nathani* in honour of the donor. These specimens are evidently from alluvial deposits, as shown by adhering grit.

CROCODYLUS NATHANI new species.

(Plate III., figures 1 and 2.)

The specific distinction of the Tara Creek crocodile is mainly demonstrated by the proportions of the mandibular symphysis, which extends barely parallel to the posterior border of the fourth tooth. This characteristic readily distinguishes it from the present-day Australian crocodiles, *C. johnstoni* Krefft and *C. porosus*, and from the fossil *Pallimnarchus pollens* De Vis.

The remains consist of three fragments of dentaries, representing two, or possibly three, individuals, several imperfect teeth, and the greater part of a frontal, with portions of a post-frontal, parietal, and of alisphenoids.

An anterior fragment of a left dentary, with part of the symphysis, contains the alveoli of six teeth, from the third to the eighth, the last being incomplete owing to fracture. The fourth, or enlarged tooth, is nearly twice the diameter of the adjoining cavities. The width of this ramus at the symphysis is 55 mm.; the height to the summit of the fourth alveolus is 57 mm., and the total length of the specimen is 110 mm. Reg. No. F. 1512. Plate III., fig. 1.

A second fragment also represents the anterior part of a left dentary, with portion of the symphysis, but this is obviously from a younger specimen, although the general characteristics are the same. It contains the alveoli of six teeth, ranging from the third to the eighth. Reg. No. *F. 1513*. Plate III., fig. 2.

Fortunately the posterior contours of the symphysis are preserved in both these specimens, and the writer is thus able to record a striking distinction between these remains and those of the two present-day Australian species (*Crocodylus porosus* and *C. johnstoni*), as well as the fossil species *Pallimnarchus pollens* De Vis.²⁵ In these Tara Creek specimens the symphysis is relatively shorter and extends barely to the posterior border of the fourth or enlarged "canine" tooth.

In *C. johnstoni* the symphysis ends parallel with the posterior edge of the sixth tooth, in *C. porosus* it extends to the posterior edge of the fifth tooth, and in the relatively far wider *P. pollens* it also ceases opposite the same tooth. Compared with De Vis' species, *C. Nathani* is much narrower in the symphyseal region; the width of the juvenile mandibular type of *P. pollens* from the symphyseal line to the alveolus of the fourth tooth is almost as great as in the less mature of the two dentaries from Tara Creek, although the teeth of the latter are nearly twice the size and the body of the dentary is far more robust.

A third fragment is from the central portion of a left dentary, and, although the broken contours do not permit actual juxtaposition, it was probably continuous in life with *F. 1512*. It contains the alveoli of seven teeth, two being enlarged and corresponding to the usual giant teeth near the posterior third of the series. Should this have been associated with the large anterior fragment, and it would be a remarkable coincidence if it were not so, it is evident that this inland reptile had six teeth, instead of the usual five, between the enlarged units of the mandibular series.

These three fragments bear a general resemblance to *C. porosus* in the sculpturing of the dentary, the presence of numerous pits and openings connected with the dental canal, and in the position of the tooth series.

Among the several specimens of teeth forwarded, no one is quite complete. The largest tooth has a maximum diameter of 25 mm., whilst the crown is 40 mm. in length. The teeth are slightly compressed laterally, and there are prominent anterior and posterior carinæ. The crowns are marked with numerous fine striations.

The actual extent of the splenial cannot be definitely stated, but, judging from the exposed facets, it terminated anteriorly near to the sixth tooth of the dentary, as in *C. porosus*.

The only cranial element consists of the greater portion of the frontal bone, although the anterior tongue is missing, with portions of the parietal,

²⁵ De Vis, Proc. Roy. Soc. Qld., II., 1886, pp. 181-191.

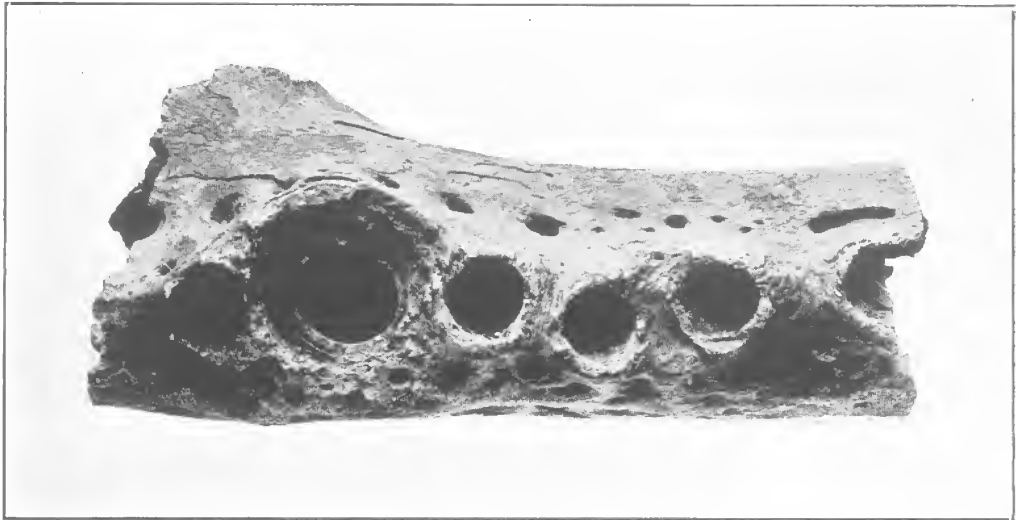


Fig. 1.—*Crocodilus Nathani* Longman. Fragment of anterior portion of left dentary. F. 1512.

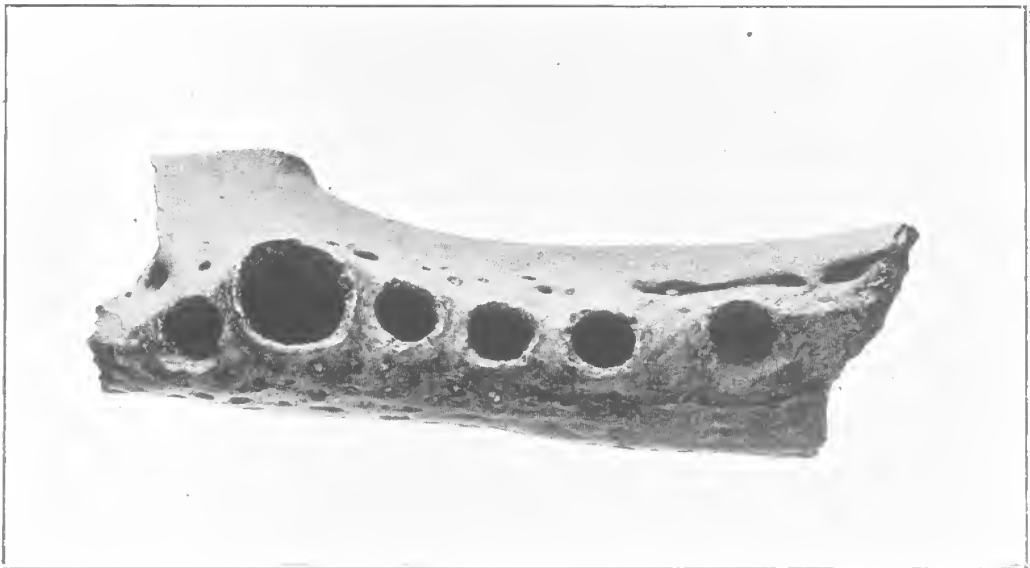


Fig. 2.—*Crocodilus Nathani* Longman. Fragment of anterior portion of left dentary. F. 1513.



the alisphenoids and the left post-frontal. The fronto-parietal suture does not reach the supratemporal fossa, owing to the backward extension of the post-frontal, this characteristic being noted by C. C. Mook as a distinguishing feature of *Crocodylus* in comparison with *Osteoblepharon*.²⁶ The superior contours of the orbits and of the supra-temporal fossa do not appear to have been very different from those of *C. porosus*, judging from the preserved portions. The external sculpturing and the size of the fossil fragments agree fairly well with the dimensions of corresponding elements on the upper part of a skull of *C. porosus*, which is 610 mm. in length. There are striking differences, however, in the comparative thickness, the frontal being little more than half the depth of the living reptile, although covering the same area superiorly. On the internal surface of the frontal the rhinencephalic groove, or sulcus olfactorius, is not so deep as in the living reptile. The contours of the alisphenoid in its connecting pier with the post-frontal are also very distinct from *C. porosus*. These distinctions are very apparent when direct comparison is made, but are somewhat difficult to put into words. They serve to emphasise the definite difference existing between the mandibles. The unusual thickness of the skull bones of *C. porosus* is noted by Mook in his valuable studies of crocodilian osteology. Reg. No. *F. 1514*; probably from the same individual as *F. 1512*.

A fragment of a large dentary from Floraville Crossing, Leichhardt River, previously referred by De Vis to *P. pollens*,²⁷ evidently belongs to *C. Nathani*. The symphyseal region is too narrow for De Vis' species, and the union terminates parallel with the posterior margin of the fourth tooth.

Affinities.—In the absence of comparative material from other parts of the world, it is impossible to deal adequately with the affinities of this inland Queensland species, as it is at present represented. Judging from the symphysis *C. Nathani* has some likeness to *C. palustris* and to *C. sivalensis*, the probable ancestor of the Indian crocodile (Lydekker).²⁸ There are, however, general resemblances to *C. porosus*, and it seems more probable that this Tara Creek crocodile was a somewhat specialised inland species, derived from the ancestors of *C. porosus*. Such reptiles found a congenial environment in the last geological period, when the inland rainfall was probably far greater. It is evident from palæontological data that species of crocodiles were far more numerous in the past in various parts of the world, and in this connection the ecological studies of these reptiles published by K. P. Schmidt²⁹ are of interest.

It should be noted that fossil remains of *C. porosus* were recorded by Lydekker (*loc. cit.*, p. 59) from the Darling Downs. In the spelling of *Crocodylus* the writer has maintained the common usage in preference to *Crocodylus*.

²⁶ Mook, C. C., Bull. Amer. Museum Nat. Hist., XLIV., 1921.

²⁷ De Vis. Ann. Qld. Mus., No. 7, 1907, p. 6.

²⁸ Lydekker, R., Catal. Foss. Rept. Amph., Pt. 1, 1888, p. 55.

²⁹ Schmidt, K. P., Bull. Amer. Mus. Nat. Hist., Vol. XXXIX., 1919.

CHELODINA INSCULPTA De Vis.³⁰

This species is at once recognisable by the great thickness of its carapace and plastron (attaining 19 mm. in places) in comparison with present-day species, as well as by the strongly marked though variable sculpturing. The largest fragment consists of the anterior moiety of the plastron, much abraded, with remains of both bridges. Another fragment is part of the right hypoplastral and xiphiplastral bones, the contours of which demonstrate that this species had a pronounced ventral curve on the extreme lateral borders of the posterior part of the plastron.

The carapace is represented by several small fragments, including remains of two posterior neurals with part of the last costal plate, the base of the left ilium being attached. An isolated right ilium, with the iliac section of the acetabulum, is fairly complete and shows that the dimensions of the pelvic elements did not exceed those of large specimens of *Chelodina expansa*, notwithstanding the thickness of the shell. This species has been previously recorded from Eight-mile Plains (near Brisbane), Darling Downs, and the Warburton River.

A NEW GIGANTIC MARINE REPTILE FROM THE QUEENSLAND CRETACEOUS.

KRONOSAURUS QUEENSLANDICUS new genus and species.

(Plate IV.)

A fragment of a very massive sauropterygian mandible, forwarded from Hughenden by Mr. A. Crombie, in 1899, demonstrates the existence in Australia in Cretaceous times of a reptile far larger than any yet put on local record. Although tantalisingly incomplete, this fragment presents such definite characters that it is desirable to describe it, so far as the evidence permits, and to give it a distinctive name.

The fossil is a portion of the anterior end of a mandible, and is 200 mm. in maximum length, 120 mm. in height, with a breadth of at least 140 mm., when allowance is made for abrasion.

Teeth.—There are remains of six very large thecodont teeth, three on each side of the symphyseal portion of a massive yet relatively narrow rostrum. Two of these teeth and the alveolus of a third are represented on Plate IV., where the external surface of the mandible is abraded. These teeth have a pronounced slope antero-posteriorly, and it is also evident that the right and left series of alveoli are set obliquely, resulting in a slight divergence of the apices of each tooth from the median line. The preserved portions of the teeth are mainly alveolar and the crowns are missing. From the remains of an unerupted or germ tooth, embedded in the fossil adjoining one of the larger teeth, it appears that the crowns were conical. There is no evidence of either

³⁰ De Vis, C. W., Ann. Qld. Mus. No. 3, 1897, p. 5.



KRONOSAURUS QUEENSLANDICUS Longman.

Fragment of mandibular symphysis, with remains of three teeth and alveoli.
Maximum length 200 mm.



carinae or flutings in the portions preserved. The immense sockets are distinctly separated, and may reach within 21 mm. of the lower margin of the mandible, but as this has been abraded the bulk of bone here may have been thicker. The teeth have a maximum diameter of 40 mm. in the upper part of the alveolar portion, and this decreases to about 30 mm. at the base. The contours are circular in horizontal sections throughout, and the slight tapering ends abruptly, as in the tooth of *Peloneustes philarchus*³¹. The maximum length of the preserved section of teeth is 140 mm., and this suggests a total length of at least 250 mm., being comparable with that of *Pliosaurus grandis*. The centre line of each tooth is situated about 65 mm. from that of its neighbour. With the exception of a circular sheath, the walls of which are 6 mm. in thickness, the preserved portions of the teeth (dentine and pulp cavity) are entirely changed into a crystalline formation identified as barytes (see Note³²). Between the white enamel-like circular sheath and the walls of the alveolus there is evidence of a thin surrounding film of matrix, which suggests that the teeth were never firmly ankylosed.

Mandible.—The condition of the mandible does not lend itself to detailed description, but it is evident that it represents a type with a pronounced rostrum, and a lengthy symphysis. On the lower surface in the median line a thin vein of matrix marks the juxtaposition of the right and left hand elements. Certain structures, which are more apparent at the anterior end, were at first thought to be splenial elements, but later study makes it more probable that these are remains of a large oval dental canal, on each side, now infilled with fine matrix, connected with the pulp cavities. The mandible in the region preserved is thought to be wholly composed of the two conjoined dentaries. On the superior surface in the median line there was a prominent ridge running above and between the alveolar borders. In his description of the mandible of *Pliosaurus grandis* Owen³³ referred (p. 5) to a median longitudinal rising formed by the interalveolar part of the "symphysis mandibulæ." The right side of the mandible, as illustrated in Plate IV., is abraded to the median line of the tooth row, but on the left side the bases of the alveoli are not exposed. In section the lower moiety of the dentaries is semi-circular, and brings to mind the contours of *Ichthyosaurus*.

It is almost certain that the three teeth preserved on each side do not represent the maximum for the symphyseal region. The right and left series of teeth are parallel, and the preserved contours suggest that in this region the lateral surfaces of the dentaries were also parallel. *Kronosaurus* evidently possessed a very lengthy and powerful mandible, with probably no great width in the posterior portion.

³¹ Lydekker, R., Catal. Foss. Rept. Amph., II., 1889.

³² I am indebted to Professor H. C. Richards for the identification of this material as barytes—"composition BaSO₄ (Barium sulphate). The barytes is very pure and very well crystallised."

³³ Owen, R., Mon. Brit. Foss. Rept., Kimmeridge Clay, III., 1869.

When first received, this fossil was tentatively labelled by the late C. W. De Vis as an *Ichthyosaurus*, but when studying the large skull of *Ichthyosaurus australis*³⁴ the writer found that it could not be placed in that family owing to the large socketed teeth and the general structure of the mandible.

Affinities.—In dealing with the difficulty of allocating fragmentary remains of plesiosaurs, S. W. Williston³⁵ referred to the provisional character of generic names. Owen and Leidy based genera on a single tooth, whilst vertebræ have been frequently used. This Queensland fossil cannot be satisfactorily placed in any genus known to the writer, although it presents some of the characteristics of *Pliosaurus* and allied genera described and illustrated by C. W. Andrews in his fine monographs on the Marine Reptiles of the Oxford Clay.³⁶ The contours of the teeth and mandible, however, seem to be quite distinct, and the resemblances may be due to homoplasy. Because of its lengthy symphysis it cannot be placed in *Cimoliasaurus*, a genus which, in Williston's words, "has served as a sort of waste-paper basket for the reception of fragments and poorly known forms." For the same reason it is excluded from the Plesiosauridæ as a sub-order. The teeth are by no means so divergent laterally as in Andrews' *Simolestes*, and they are larger, straighter, and not so tapering in the alveolar region as in *Peloneustes evansi*. In the circumstances it seemed necessary to give this gigantic marine reptile from the Australian Cretaceous generic and specific names, and it is firmly believed that when other remains are forthcoming of *Kronosaurus queenslandicus* that this course will be found fully justified. The lengthy symphysis, massive mandible, and very large teeth set in separate sockets, are outstanding features that suggest affinities, however, and the fossil is placed provisionally in the sub-order Pliosauridæ of the Plesiosauria, the latter term being used in preference to Sauropterygia in view of Boulenger's remarks in 1917.³⁷ Andrews records this sub-order as ranging from the "Lower Jurassic to the Upper Cretaceous of Europe." (1913, p. 1).

Matrix.—This is similar to that associated with other vertebrate remains from the Hughenden district such as *Ichthyosaurus* and *Cratochelone*, described by the writer, being a fine-grained calcareous mudstone.

Other Queensland Cretaceous reptiles include *Plesiosaurus macrospondylus* McCoy and *P. sutherlandi* McCoy,³⁸ regarded by Etheridge as *Cimoliasaurus*,³⁹ which were described from vertebræ, the dimensions of which do not suggest so large a reptile as *Kronosaurus*. *Cimoliasaurus leucoscopelus* and *C. maccoyi*, described by Etheridge (1897 and 1904)⁴⁰ from interesting remains found at White Cliffs, New South Wales, which had been converted into opal, may be also excluded for the same reason.

³⁴ Longman, H. A., Mem. Qld. Mus., VII., 1922, pp. 246-256.

³⁵ Williston, S. W., Field Columbian Mus., Geol. Sur., 1903, II.

³⁶ Andrews, C. W., Catal. Mar. Rept. Oxford Clay, pts. 1 and 2, 1910-1913.

³⁷ Boulenger, P.Z.S., 1917, p. 221.

³⁸ McCoy, F., Ann. Mag. N. H., XIX., 1867, p. 356.

³⁹ Etheridge, R., Rec. Aus. Mus., III., 1897, p. 19.

⁴⁰ Etheridge, R., Rec. Aus. Mus., V., 1904, p. 306-316.

ON SOME NEW AND LITTLE-KNOWN AUSTRALIAN
FULGOROIDEA (HOMOPTERA).

BY F. MUIR, HAWAIIAN SUGAR PLANTERS' EXPERIMENT STATION, HONOLULU, T.H.

(Six Text-figures.)

THE following paper deals with part of a small collection forwarded to me by the Queensland Museum. Some Cixiidæ still await identification as the writer is at work on a revision of the genera of that family. Two species in the Hawaiian Sugar Planters' Association Experiment Station collection are included. The types are in the Queensland Museum unless otherwise stated. Measurements are from apex of head to anus, and from base to apex of one tegmen.

DERBIDÆ.

EOCENCHREA HIVA (Kirk).*Lanenia hiva* Kirkaldy. H.S.P.A. Exp. Stn. Ent. Bull. I. (9), p. 404 (1906).

One male and one female from Brisbane (H. Hacker, 5-2-1922). This was described from a single female. The male is similar in structure and colour. Lateral margins of pygofer subangularly produced, ventral margin straight; anal segment small, anus near apex which is rounded; genital styles wide, flat, outer margin slightly concave in outline, inner margin slightly convex, apex but slightly narrower than base, subtruncate.

EOCENCHREA PULLA sp. n.*Male*.—Length 1.4 mm.; tegmen 3.2 mm.

In build this species is similar to *E. hiva*. In colour it is all black or very dark brown, with the legs slightly lighter. At the node there is a faintly light spot. Lateral margins of pygofer angularly produced, ventral margin straight; anal segment small, about as long as broad, anus at apex; genital styles broadest at base, gradually narrowing to apex which is rounded.

Described from one male from Hornsby, N.S.W. (F. Muir, January, 1920). Type in Hawaiian Sugar Planters' Association Experiment Station collection, No. 1102.

PHANTASMATOCERA PULCHELLA sp. n.

(Text-figure 1.)

Male.—Length, 2.7 mm.; tegmen 4.2 mm.

Vertex about as long as broad, lateral margins thick and produced at apex, base and apex roundly emarginate; face widest at base, in profile base

considerably produced; antennæ not as long as face, very slightly flattened. Lateral margins of pygofer roundly produced, ventral margin straight; anal segment in dorsal view longer than wide, base slightly wider than apex, anus at apex, apical margin with a small emargination in middle; genital style figured.

Light yellow with white waxy secretion, antennæ and a line in front of eyes black or fuscous, the line continued behind eyes over sides of pronotum and mesonotum; fuscous over abdominal tergites. Tegmina hyaline, white with waxy secretion, fuscous over middle of clavus, Cu and basal median sector into apical Cu M. cells, a black spot on cross vein at apex of M, veins same colour as membrane or slightly yellow; wings hyaline with light veins, opaque with waxy secretion.

Female similar to male but the antennæ are terete and in profile, the base of face not projecting so much. Hind margin of seventh abdominal tergite roundly produced in middle, with a minute emargination in middle.

Described from two males and two females from National Park, Queensland (*H. Hacker*, December, 1921). Type in Queensland Museum, *Ho.* 2752.

P. pseudopalidocornis was described from one female and the genitalia is very close to *pulchella*, but the colour of tegmina is different.



Text-figure 1.—*PHANTASMATOCERA PULCHELLA*;
left genital style.



Text-figure 2.—*HERONAX DUBIUS*.

- (a) Lateral view of ♂ genitalia;
(b) ventral view of ♀ pregenital plate (7th sternite).

KAMANDAKA LONGMANI sp. n.

Kamandaka Distant. Faun. Brit. Ind. Rhyn. III, p. 310 (1906).

Eosaccharissa Kirkaldy, Brux. Ann. Soc. Ent. p. 127 (1907). Subgenus of *Kamandaka*.

Chaprina Distant = *Eosaccharissa* Kirk.

Tapoosa Distant = *Eosaccharissa* Kirk.

Nicertoides Matsumura Die Schäd. und Nutzl. insekten v. Zuckerrohr Formosa, p. 14 (1910). Subgenus of *Kamandaka* Dist.

Elsewhere¹ I have tried to define the limits of the three subgenera which I place under *Kamandaka*. The present species falls into *Eosaccharissa* which has the face in profile strongly curved on apical half.

Female.—Length 3.4 mm.; tegmen 6.5 mm.

¹ Ent. Mo. Mag. iv, (3), Oct., 1918, p. 240.

Stramineous; a dark mark on gena in front of eyes and behind eyes on pronotum, fuscous along the lateral margins of vertex, on front femora and over abdominal tergites. Hind margin of pregenital plate (seventh sternite) angularly produced from near the lateral corners to middle, the sides of the production slightly curved. Anal segment longer than wide, anus in middle, apex round.

Described from one female from National Park, Queensland, 3,000 feet elevation (*H. Hacker*, December, 1921). Type in Queensland Museum, *Ho.* 2753.

HERONAX DUBIJS sp. n.

(Text-figure 2.)

Male.—Length 2.8 mm.; tegmen 6.4 mm.

A very small subantennal process, but no trace of shoulder keel; antennæ shorter than face, wide and considerably flattened. Forking of claval veins about one fourth from apex.

Light brown or yellow; middle of clypeus darker brown; abdominal tergites fuscous over the medio-lateral portion; pygofer dark, anal segment and styles light; front and middle tibiæ with a small dark band in middle and another at apex. Tegmina hyaline with reddish brown markings; a V-shape mark from apex of clavus to fork of Cu to base of M where it continues along R cell to apex, and across to apex of Cu 1 with four round hyaline spots in the middle; dark over apical cells where there is a darker spot over median apical veins; five or six small dark marks in costal cell; veins dark in dark areas, and yellowish in light areas. Wings hyaline, slightly fuscous, veins fuscous, the Cu darker than the others.

Pygofer very short on sides, longer ventrally, ventral margin simple, lateral margins angularly produced on dorsal half; anal segment long, anus one-third from apex in dorsal view; sides very slightly converging to anus, then more strongly so, apex bifurcate and turned ventrad. Genital style broad at apex which is subtruncate, narrow at base, outer margin slightly sinuous, with apical corner produced into a spine, inner apical corner rounded, inner margin nearly straight to near base where it is produced into a small, pointed process curved inward, a small process on the inner surface near base. Aedeagus not dissected out.

Female.—Length 3.2 mm.; tegmen 7 mm.

Similar to male but darker in colour; the apical third of tegmen dark with three light spots along the media.

Pregenital plate 5-sided, base about half the width of apex, straight, apex angular, sides very slightly sinuous, concave in middle.

Described from one male and one female from National Park, Queensland, 3,000 feet elevation (*H. Hacker*, December, 1921). Type and allotype in Queensland Museum, *Ho.* 2754.

The type material of *H. parnassius* Kirk. consists of a single specimen without an abdomen. Although it is considerably lighter in colour than *H. dubius*, yet there is a possibility of their being the same. Males from Cairns; the type locality of *H. parnassius* will decide the question.

The two genera, *Mysidioides* Mats. and *Heronax* Kirk, run near together. In the former there are distinct shoulder keels and subantennal plate, whereas in the latter they are wanting, or only one is present in a very rudimentary form.

ACHILIDÆ.

TROPIPHLEPSIA gen. nov.

A very small costal area at the base of tegmen; apex of clavus in middle; Sc + Rf basad of apex of clavus, M joined to Sc + R forming a common stalk at base, Mf level with node, M 1 and 2 forking considerably basad of apical cross veins, M 3 and 4 forking near to cross veins, M 3 + 4 joining Cu 1 for short distance, Cu f slightly basad of apex of clavus, Cu 1 curved out to meet M 3 + 4: clavus roundly closed, claval vein entering apex of clavus, the second claval vein sinuous and raised into two keels, the large basad of fork the smaller distad of fork. There is also a very slight keel on Cu 1A, Cu stem, M and Sc + R.

Width of vertex at apex four times the length in middle, apex truncate, base slightly and roundly emarginate, apex slightly narrower than base, margins carinate, a median longitudinal carina. Base of frons slightly broader than apex, sides slightly arcuate, carinate continuing on to clypeus, median carina on frons and clypeus obscure, clypeus short. Antennæ small, globose. Pronotum short, anterior margin fitting into base of vertex, posterior margin widely angularly emarginate, a median carina; mesonotum a little wider than long, tricarinate. Legs short, front, and middle femora slightly flattened.

This genus can be recognized by the condition of the second claval vein.

TROPIPHLEPSIA BADIA sp. n.

(Text-figure 3.)

Female.—Length 3.5 mm.; tegmen 5.7 mm.

Vertex and nota dark brown speckled with small light spots; frons much lighter speckled with lighter spots; legs and pleura dark brown with lighter spots; abdomen dark brown with the hind margins of tergites light. Tegmina brown, darker over clavus, across the middle, through the subapical cells and at apex, veins dark with light specks along them also extending into the costal and apical cells. Wings light fuscous with darker veins.

Pregenital sternite (seventh) with posterior margin deeply angularly emarginate; ovipositor incomplete, sheaths not completely covering ovipositor; anal segment small.

Described from one female from Brisbane (*H. Hacker*, October, 1917). Type in Queensland Museum, *Ho.* 2755.



Text-figure 3.—*TROPIPHLEPSIA BADIA*. (a) Left tegmen; (b) showing raised claval vein.



Text-figure 4.—RIGHT GENITAL STYLE. (a) *GAETULIA CHRYSOPOIDES*; (b) *G. KOERELEI*.

RICANTIIDÆ.

GAETULIA HACKERI sp. n.

Female.—Length, 6.5 mm.; tegmen 8.4 mm.

Vertex distinctly longer than wide, apex narrower than base and angular, base angularly emarginate, sides carinate, disc excavate; frons considerably longer than wide, base narrower than apex, widest slightly before apex, sides straight to near apex then curved, carinate, a strong median carina; clypeus with a median carina, no lateral carinae. Antennae small, globose. Pronotum short, hind margin widely angularly emarginate, anterior margin produced into angular emargination of vertex, lateral carinae large, diverging, not reaching hind margin, median carina obscure; mesonotum slightly longer than wide. Middle of mesonotum broken by pin so carinae cannot be observed. Venation of tegmen normal, Sc + Rf very slightly basad of Mf and Cuf, apical cross veins of M contiguous, forming a line, those of Sc and R irregular. Costal membrane with ten cross veins. The apex of costal cell not forming a small knob as in *G. chrysopoides* (Walk.).

Apex of abdomen rounded; anal segment small; ovipositor incomplete, sheaths wide, rounded, together forming a hemisphere covering the ovipositor.

Three black, longitudinal lines on frons, one over median carina which extends on to clypeus and the other two between carinae; lateral carinae, genae, and sides of clypeus stramineous; middle of vertex fuscous, carinae stramineous, nota stramineous with fuscous markings forming longitudinal lines on mesonotum. Abdomen dark stramineous or light brown, lighter on the outer portions of tergites and on hind margins, first visible sternite (true third) light yellow,

others fuscous yellow. Tegmina clear hyaline, veins dark brown, costal vein and basal cell lighter, a small dark brown spot at apex of costal cell; wings clear hyaline, veins dark brown, a fuscous mark on apical portion of anal area.

Described from one female from Russell Island, Queensland (*H. Hacker*, 2-12-1921). Type in Queensland Museum, *Ho.* 2756.

This species appears to be more typical of the genus than *G. chrysopoides* (Walk.).

GAETULIA KOEBELEI sp. n.

(Text-figure 4.)

Male.—Length, 5.3 mm.; tegmen 7.3 mm.

Width of vertex about twice the length in middle, apex slightly angularly produced, base widely angularly emarginate, a very faint carina down middle. Width of frons subequal to length in middle, base subequal to apex in width, slightly widest slightly before apex, sides straight to near apex then slightly curved, median longitudinal carina distinct; clypeus with median carina but no lateral carinae. Pronotum short, anterior margin produced into base of vertex, posterior margin widely angularly emarginate. Mesonotum with three carinae. Costal area with fourteen cross veins; apex of costal cell slightly enlarged. Sc + Rf and Cu f about level, Mf slightly more distad, apical cross veins gradate, not forming a continuous line.

Light brown, the carinae of head and thorax lighter. Tegmina hyaline, clear, veins dark brown, a light brown spot at apex of costal cell and another at apex of anal area of wings which are otherwise clear hyaline with brown veins.

The genitalia is very near to *G. chrysopoides* (Walk.), but the genital styles are larger, wider, and have the outer margins straight; the outer apical angle is produced into a bifurcate process like a pick.

Described from one male from Mittagong, N.S.W. (*A. Koebele*, January, 1905). Type in Hawaiian Sugar Planters' Association Experiment Station collection, No. 1101. This species differs in colour, size, and genitalia from *G. chrysopoides* (Walk.). From *G. nigrovenosa* Melichar it differs in the wider vertex and frons, in having no small hairs on the frons, in the shape of the apex of costal cell and the genital styles.

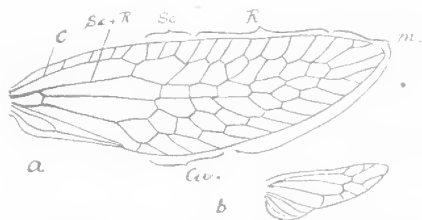
Distant erected the genus *Nurunderia* for *chrysopoides* Walk. on account of a small difference in the shape and size of head, especially the face, but cannot recognise them as of generic importance.

PARALASONIA gen. nov.

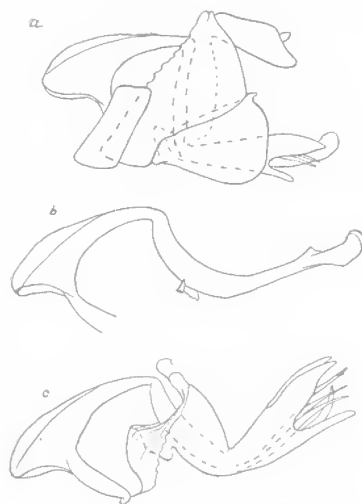
Tegmina narrow, pointed at apex. Costal area short and narrow with three or four cross veins; Sc + R joined to apex of costal membrane, level with apex of clavus, Mf slightly more distad and Cuf slightly more basad; from the costal area to apex of clavus there is a row of apical cells subequal in length. Wings small, one-third the length of tegmen.

Head as broad as, or slightly broader than, the thorax; vertex subquadrate, apex slightly broader than base, slightly rounded with the tumid frons projecting, base slightly excavate, sides straight with slight carinae, middle without carina. Frons shorter than wide, especially on the middle line, fronto-clypeal suture arcuate, somewhat obscure, sides of frons subparallel to near apex, where they converge slightly, the middle of the frons tumid; clypeus without carinae. Pronotum short, hind margin widely angularly emarginate, tricarinate, the lateral carinae curved, not reaching hind margin. Mesonotum broader than long, obscurely tricarinate. Hind tarsi short, basitarsus wide, swollen. Antennae small, first segment very short, second segment about as long as wide.

This genus comes next to *Lasonia* Melichar. Both of them come near *Gaetulia* Stål. The division of the family into groups on the proportional length and breadth of the frons is unnatural. I believe that a classification based on the venation and checked by a study of the male genitalia will give better results.

Text-figure 5.—*PARALASONIA AUSTRALIS*.

(a) Right tegmen; (b) right wing;
(c) costa; m, media; Cu, cubitus;
Sc + R, subcosta and radius joined.

Text-figure 6.—*PARALASONIA AUSTRALIS*. (a) Lateral view of ♂ genitalia; (b) lateral view of aedeagus without penis; (c) lateral view of penis.

PARALASONIA AUSTRALIS sp. n.

(Text-figures 5 and 6.)

Male.—Length 4.7 mm.; tegmen 7 mm.

Ochraceous, perhaps when living green or greenish yellow; vertex with a longitudinal median black mark, the apical margin black, curving inward at the margins; frons with a small black mark in middle and a few at the sides, clypeus with four or five fuscous marks on each side; fuscous over carinæ of nota; a small dark spot in the middle of the posterior margin of the abdominal terga. Tegmina and wings clear hyaline, veins black except the claval suture; base of claval veins and basal cell which are colourless or light yellow.

Pygofer laterally compressed, lateral margin subangularly produced; anal segment small, anus at apex; genital styles large, subtriangular, the outer apical corner produced into a small, curved spine, the inner apical corner rounded. Aedeagus complex. The periandrium forming a funnel. The ventral margin of the apex produced into a membranous process, dorsal margin into two large processes, broad at base but pointed at apex, from within the funnel arises two pair of processes, on the left they are both long, slender, straight spines, but on the right one is straight and slender, the other is broader at base and curved; the penis arises in the middle and is a curved, slender tube rounded at apex where it is cleft for a short distance, with a little spine on dorsal surface near apex.

Described from one male from National Park, Queensland (*H. Hacker*, December, 1921). Type in Queensland Museum, *Ho.* 2757.

FIELD NOTES ON *PLATYBRACHYS*, &c.
(HOMOPTERA).

BY HENRY HACKER, F.E.S.

(Plates V.–VIII.)

FAMILY EURYBRACHIDÆ.

PLATYBRACHYS LEUCOSTIGMA (Wlk.).

Eggs.—Length 1.87 mm., width 1 mm.; oval, opaque, smooth, with creamy or pale greenish tint. Examined microscopically there is a small stud-like protuberance at the cephalic end, which is bright yellow in a balsam mount and appears to be of a fibrous nature. Under higher magnification, at the opposite end is a minute colourless protuberance around which small typical micropylar cells can be distinguished. The egg shell is colourless and finely granulated.

The egg patches are conspicuous objects on the trunks of Spotted Gums, *Eucalyptus maculatus*, in this district. During February numerous females were observed ovipositing on the trunks of these trees, generally at a height of three feet to twenty feet or more from the ground. The bark of spotted gum comes off in small scales, leaving oval depressions or scars. These are the places selected by *P. leucostigma* for oviposition. They take up a position in the centre of these hollows during the operation, and place the eggs in neat rows, moving gradually upward as the rows are completed. To place the outside eggs in position, the insect inclines its body from side to side without shifting its central position. When each row is completed she rubs the posterior end of her body over the eggs, covering them with white material from a mass which is situated there. This covering is carried half an inch beyond the eggs on each side, and the method is plainly indicated by the curved striæ across the egg-covers in fig. 2. The eggs are fastened to the bark rather firmly, with their upper ends inclining away from the tree. In the central part of the depression they are placed two deep, and the covering is finished off flush with the surrounding bark.

Nymphs.—The young nymphs emerge through slits in the outer side of the shells which extend from the stud-like protuberance to the middle and

push their way through the waxy covering, making ragged tears and cracks. They are pale yellow, with black eyes, and remain motionless in a cluster on the white cover. After a few hours they become grey. On the second day the two long tails characteristic of these and other *Platybrachys* nymphs appear. On the third or fourth day the cluster breaks up, and they scatter over the tree, going up into the higher branches.

The two anal appendages of *Platybrachys* nymphs consist of excremental material. It is forced through two circular plates situated on either side of the last segment. They are divided into many small compartments by fine radiating and concentric lines, somewhat resembling the markings on an *Arachnoidiscus* diatom. These circular plates are present in nymphs of all ages. Even when newly hatched they are present, but are, of course, much smaller and contain fewer compartments. After passing through these plates the excrement is drawn out into long bundles of fine glassy filaments, tightly twisted until near the apical ends, which become untwisted and brushlike. The appendages are constantly growing, but as the loose ends (being very brittle) are continually being abraded, the average length remains constant in the different instars, reaching a maximum of about 12 mm. in the last. After each moult they are left behind on the discarded skins, but others soon appear and gradually lengthen until the maximum is reached.

Platybrachys are double brooded; from eggs hatching in February the winter months are passed in the nymphal state, the adults emerging in spring. From eggs laid in September, the summer months are passed in the nymphal state, the adults appearing in February. The latter is the main brood.

Considering the unprotected condition of these insects in all their stages, and the number of their enemies, both predatory and parasitic, it seems incredible that any can survive, as their only defence seems to be their ability to make quick leaps. It is evident, however, that large numbers do escape, as they are numerous in all our eucalyptus forests.

A Pentatomid bug *Theseus modestus* Stål, both in its larval and adult stages, is very fond of *Platybrachys* eggs. They have frequently been observed on the egg patches with their rostra inserted through the covering. Two Chalcids¹ and a Proctotrypid² parasite were often noticed on the egg patches. I have bred out all three from gathered eggs. They are *Fulgoridicida nigricorpus* Gir. (Family Encyrtidæ), *Euryischia unmaculatipennis* Gir. (Family Elasmidæ), and *Aphanomerus niger* Perk.

¹ Identified by A. A. Girault.

² Identified by A. P. Dodd.

Sometimes the egg patches are so situated that in heavy rain they are exposed to streams of water flowing down the tree trunks. If the covering should become injured so that the eggs are exposed, they are quickly discovered by ants, which cut the eggs out and carry them away. On two occasions nymphs were captured carrying white external parasites on the dorsal surface. These left the nymphs soon after, and formed white cocoons, from which emerged small moths (Family Epipyropidæ). Sometimes the adults are heavily infested with Dryinid parasites. There is an adult female specimen before me with six larval sacs of these wasps attached to its abdomen.

I might state that all the activities of *Platybrachys* recorded here, including their emergence, were carried on during the day. The pair of *P. decemmacula* taken in copula were found early in the afternoon. All the egg patches were commenced in the morning and finished before nightfall. The adults are less active towards evening and in dull weather. If disturbed late in the day, instead of immediately flying back to the tree trunks they hide among the grass or dead leaves at the foot.

PLATYBRACHYS LEUCOSTIGMA (Wlk.) = **PLATYBRACHYS ÆRATA** Dist.

Having collected during two years a long series of *P. leucostigma* Wlk., I was much struck by the fact that they were all females. In a long series of *P. ærata* Dist. taken during the same period all the specimens were males. Although without the proof which a pair taken in copula would give, I feel sure that *P. leucostigma* Wlk. and *P. ærata* Dist. are sexes of the same species. They both occur plentifully on Spotted Gums at the same time. Furthermore, by considering these to be a single species both sexes of every species of *Platybrachys* occurring commonly in the Brisbane district will be accounted for. The list is as follows:—

- Platybrachys signata* Dist. ♂ ♀.
- Platybrachys sanguiflua* (Walk.) ♂ ♀.
- { *Platybrachys decemmacula* (Walk.). ♀.
- { *Platybrachys decisa* (Walk.). ♂.
- Platybrachys oculata* Kirk. Dark var. ♂ ♀.
- Platybrachys maculipennis* Le Guill. ♂ ♀.
- { *Platybrachys leucostigma* (Walk.). ♀.
- { *Platybrachys ærata* Dist. ♂.

PLATYBRACHYS MACULIPENNIS Le Guill.

The feeding tree of this species is Stringy Bark, *Eucalyptus acmenoides*. Instead of ovipositing on the tree trunks like *P. leucostigma*, the female places her egg patches on the leaves. Either surface of a leaf may be used for this purpose,

probably because they all hang vertically. The covers are white and smooth, 18 mm. long and 11 mm. wide. The average cluster contains between twenty and thirty eggs. The eggs are oval, length 1.50 mm.; breadth .75 mm., and are without the stud-like protuberance possessed by those of *P. leucostigma*.

PLATYBRACHYS DECEMMACULA (Wlk.) = **PLATYBRACHYS DECISA** (Wlk.)

On February 18th a pair were seen in copula on a tree trunk. They were carefully boxed and brought back alive. When examined it was found that the female was *P. decemmacula*, while the male was identical with a specimen recently returned from the British Museum as *P. decisa*. Both sexes are figured on Plate VII., fig. 12.

OLONIA VIRIDIVENTRIS Stål.

This species is rather local. It has been taken at two places in the Brisbane district, and specimens have been received from Toowoomba and Bribie Island. Its feeding tree about Brisbane is *Acacia cunninghamii* Hook. The eggs have not yet been found, nor have the nymphs been recognised with certainty, as nymphs and adults of *Gelastopsis transversa* Walk., and *Dardus abbreviatus* Guér., both occur and feed on the same clumps of Wattles. *O. viridiventris* approaches *Platybrachys* rather than *Olonia* in the shape of the tegmina. The pronotum and scutellum together are shorter than wide, and this places the species in *Olonia*. In *Platybrachys* the pronotum and scutellum together are as long as wide.

The following collecting notes give some particulars about the new species described by Mr. F. Muir in this Part, and may be considered supplementary to that paper.

DERBIDÆ.

PHANTASMATOCERA PULCHELLA Muir.

This species was found in December occurring in large numbers on the long flag-like leaves of *Helmholtzia glaberrima* at Canungra Creek Falls, National Park, 2,000 ft. There is little doubt that this is its feeding plant, as although all the surrounding vegetation was beaten, they were found only on this giant lily. When disturbed they fly rather weakly, either to the nearest foliage, or circle round and return to the lily leaves.

KAMANDAKA (EOSACCHARISSA) LONGMANI Muir, and **HERONAX DUBIUS** Muir.

Both these species were obtained in dense jungle at the National Park, 3,000 ft. Most of the series were beaten out of dead tree-fern fronds. The dead fronds hang vertically round the stems, and make good shelters during the day for these delicate insects. It is also a favourite hiding place for numerous species of Microlepidoptera, to many of which the Derbiids bear a superficial resemblance.

RICANIIDAE.

GAETULIA HACKERI Muir.

Taken at Russell Island, Moreton Bay, in December. Their feeding tree is She-oak, *Casuarina* sp. They hide at the base of the trees during the day. About dusk both nymphs and adults were observed ascending the tree trunks to feed in the higher branches. They seem to prefer young trees about 20 ft. high with a trunk about the thickness of one's arm. The nymphs carry a long tuft of white filaments at the apex of their abdomens.

PARALASONIA AUSTRALIS Muir.

This remarkable-looking insect has been found in two widely separated localities. At Russell Island they were taken at dusk, on *Casuarina*, in company with *Gzulia hackeri* Muir. At the National Park, at a low elevation they were obtained during the day by sweeping grass and herbage under *Casuarina* trees. As in both localities they were found associated with *Casuarina*, this may, I think, be safely considered to be their feeding tree.

EXPLANATION OF PLATES.

PLATE V.

- Fig. 1.—*Platybrachys leucostigma* (Wlk.) Egg patches on the trunk of a spotted gum.
- Fig. 2.—*Platybrachys leucostigma* (Wlk.) Young nymphs emerging from eggs. $\times 1.75$.
- Fig. 3.—*Platybrachys leucostigma* (Wlk.) Young nymphs two days old. $\times 1.5$.
- Fig. 4.—*Platybrachys leucostigma* (Wlk.) Four females on tree trunk, one of which has just completed an egg patch. $\times 6$.

PLATE VI.

- Fig. 5.—*Platybrachys leucostigma* (Wlk.) Egg showing stud-like protuberance (Balsam mount). $\times 40$.
- Fig. 6.—*Platybrachys leucostigma* (Wlk.) Newly-hatched nymph (Balsam mount). $\times 23$.
- Fig. 7.—*Platybrachys leucostigma* (Wlk.) Nymphs. Last instar. $\times 2$.
- Fig. 8.—*Platybrachys leucostigma* (Wlk.) Adult females. $\times 2.5$.

PLATE VII.

- Fig. 9.—*Pentatomid bug*. Larva feeding on eggs. $\times 1$.
- Fig. 10.—*Platybrachys maculipennis* Le Guill. Egg patches on leaves of stringy bark. $\times 1$.
- Fig. 11.—*Platybrachys maculipennis* Le Guill. Adults, male and female. $\times 3$.
- Fig. 12.—*Platybrachys decemmacula* (Wlk.) Adults, male and female. $\times 3$.

PLATE VIII.

- Fig. 13.—*Olonia viridiventris* Stål. Adults, male and female. $\times 2.75$.
- Fig. 14.—*Platybrachys leucostigma* (Wlk.) Adult males. $\times 2.75$.
- Fig. 15.—*Platybrachys leucostigma* (Wlk.) Last abdominal segment of nymph, showing circular plates. $\times 100$.



Fig. 1.

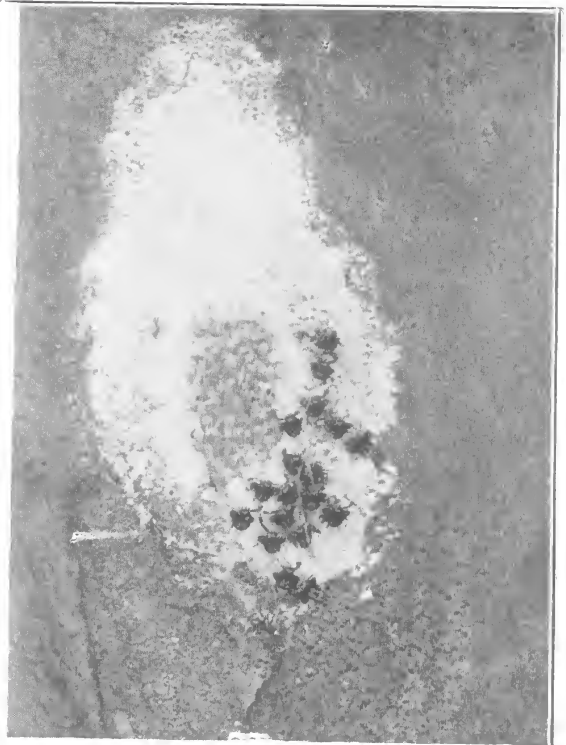


Fig. 3.

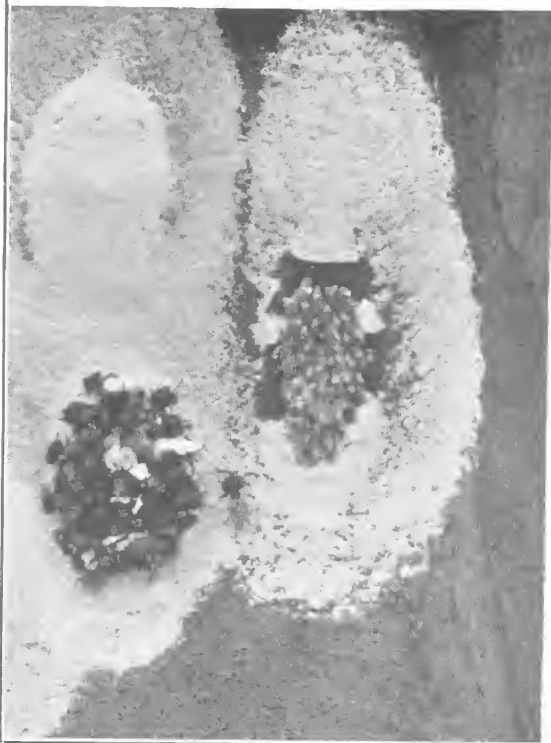


Fig. 2.



Fig. 4.

Photo., H. Hacker.





Fig. 5.



Fig. 7.



Fig. 6.

Photo., H. Hacker.



Fig. 8.

Face page 42.





Fig. 9.



Fig. 11.



Fig. 10.



Fig. 12.

Photo., H. Hacker.

Face page 42.





Fig. 13.



Fig. 14.

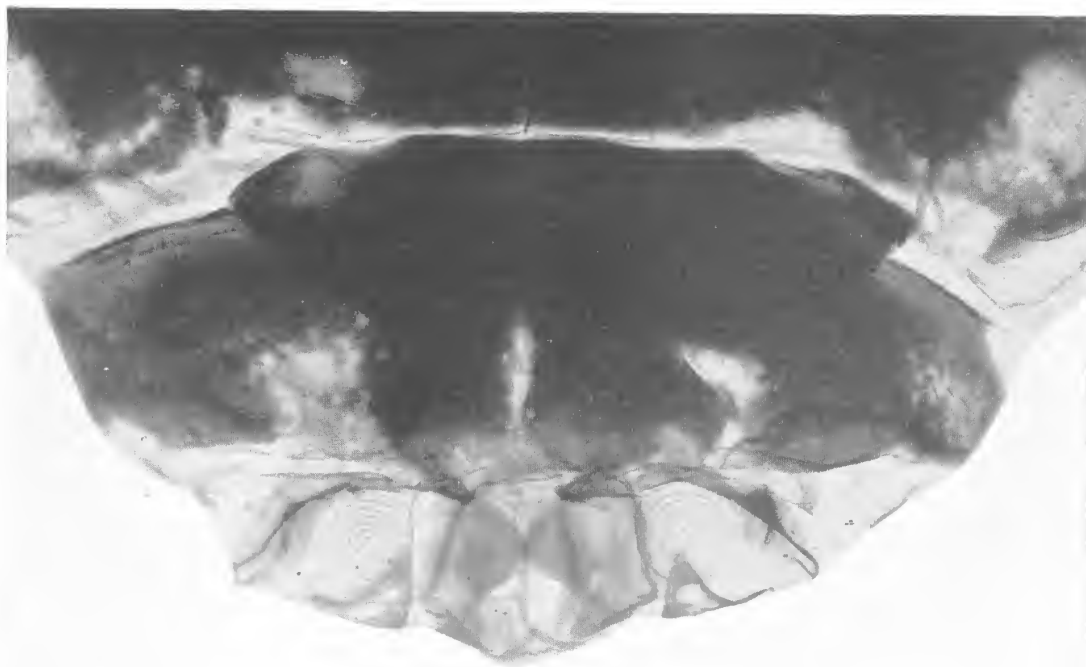


Fig. 15.



THE EARLY STAGES OF *DANAIDA AFFINIS* Fabr.

BY HENRY HACKER, F.E.S.

(Plate IX.)

DURING a holiday spent on Bribie Island in January, 1922, large numbers of *Danaida affinis* were seen on the wing. By watching the females, many of which were ovipositing, good series of eggs, larvæ, and pupæ were obtained. Their food-plant, *Vincetoxicum carnosum* Benth., was found growing on the edges of salt creeks and swamps, always among reeds, to which the plants cling for support.

Eggs.—The eggs are cream-coloured, conical, with many rows of longitudinal ridges, between which are fine transverse striæ. They are deposited singly on the leaves. Compared with eggs of *D. archippus*, they are slightly more elongate, and have more pointed apices.

Larvæ.—The full-grown larvæ are smooth and cylindrical. Dorsally on the second, fifth, and eleventh segments respectively there are situated three pairs of tapering appendages, of which the basal third is red, the apical two-thirds black. Head black, shining, carrying dorsally two semicircular narrow white bands; front with a small white spot. Body with blue ground colour,¹ the lighter markings on the dorsal surface consisting of two yellow spots, and three white spots, arranged in two transverse rows, behind which are three transverse interrupted light stripes on each segment; lateral markings consist of three or four small light spots on the anterior segments, increasing to eight or ten on the others. There is also a small elongate light spot on the outer side of each thoracic leg and abdominal proleg.

Pupæ.—Short and stout, the greatest circumference being a ridge round the abdomen ornamented with a band of bead-like golden spots; there are four golden spots near the anterior end; colour pale green. The pupa is suspended by a short black stalk, from the base of which on the inner side extends a black bifurcated mark, beyond which there are a pair of small black tubercles.

The insects when about to pupate invariably attach themselves to the reed stems, instead of their feeding plants, as they afford them a stronger support.

Parasites.—A number of living pupæ were brought back to Brisbane. From several of these, Chalcid parasites emerged singly from each, by cutting a

¹ In spirit specimens, or inflated skins, the blue ground colour changes to purplish red, and the yellow spots become whitish.

circular hole in the side. A. A. Girault, to whom they were submitted, states that this is a new variety of *Chalcis brisbanensis* Gir., which he is naming *Chalcis brisbanensis danaidæ*.

Distribution.—The first larvæ were obtained on Russell Island in December 1921, on the edge of a small salt-water lagoon, on the same food plant, and under similar conditions to those taken on Bribie Island. Waterhouse and Lyell give a wide range of localities for this butterfly, extending from Cape York to Sydney on the east coast; also Derby (W.A.), Darwin, Melville Island, etc. The distribution of *Vincetoxicum carnosum* coincides with that of the butterfly. Mr. C. T. White, Government Botanist, who kindly identified the plant, states:—"It has a wide range, including the islands of the Gulf of Carpentaria, Port Curtis, Moreton Island, Rockingham Bay, and extends in New South Wales to the Port Macquarie district."

EXPLANATION OF PLATE IX.

Fig. 1.—*Danaida affinis*, Fabr. Eggs $\times 11$.

Fig. 2.—*Danaida affinis*, Fabr. Larvæ and Pupa $\times 1$.

Fig. 3.—*Danaida affinis*, Fabr. Female ovipositing.



Fig. 3.



Fig. 1.



Fig. 2.

Life History of *Danaida affinis* Fabr.

Photo., H. Hacker.



THE AUSTRALIAN SPECIES OF *AULACOPHORA* (COLEOPTERA, CHRYSOMELIDÆ).

BY ARTHUR M. LEA, F.E.S.

(Contribution from the South Australian Museum.)

THE genus *Aulacophora* is abundantly represented in the Malay Archipelago, New Guinea, the warmer parts of Australia and elsewhere. Many of the species are widely distributed and variable; on the other hand, some at first glance appear to be closely allied or identical with others from which they may be readily distinguished by male characters of the antennæ and abdomen.

Baly in 1886¹ gave a table of most of the then-known species, with notes and descriptions, supplementing these in 1888².

Allard in 1888³ gave tables of the genera and species of the Aulacophorites, with a list of the species, many synonyms being noted.

Baly in 1889⁴ in criticising Allard's paper remarked: "This paper bears marks of hasty compilation and of insufficient study of the various specific forms; numerous errors have consequently crept in." He gave many instances of these.

As some of the species are very destructive, it appears desirable to comment upon each of those recorded for Australia, some undoubtedly in error. With one exception all the Australian species occur in Queensland, but of these several extend to other States and a few to New Guinea and elsewhere.

A. abdominalis Fabr. Baly⁵ was the first to record this species as Australian. In Gemminger and Harold's catalogue the species is recorded from Europe, Africa, and Asia, and seven synonyms are noted. In Allard's catalogue *A. excisa* of Baly is added, and it is also recorded from New Zealand, &c. Baly considered Allard's identifications erroneous. Blackburn stated of *A. palmerstoni*: "Mr. Jacoby informs me that this is not distinct from *A. abdominalis* Fabr."⁶ There are specimens of the species in the South Australian Museum from Queensland, Northern Territory, North-western Australia, and Aru; it differs from *A. wilsoni* by the transverse impression of pronotum undulated in middle, the scutellum pale, and more of the under-surface and legs pale, but the dark parts of the legs and abdomen vary in extent and degree.

¹ Baly, Journ. Linn. Soc., Zool., xx, pp. 1-26.

² Baly, *loc. cit.*, pp. 175-185.

³ Allard, Ann. Soc. Ent. Fr., pp. 305-332.

⁴ Baly, Trans. Ent. Soc., pp. 297-307.

⁵ Baly, *loc. cit.*, 1886, p. 14.

⁶ Blackburn, Trans. Roy. Soc. S. Aust., 1893, p. 233.

A. affinis Montr. This species was originally recorded from New Caledonia, and the elytra were described as reddish, with two black bands, one at the base the other at the apex. Allard considered that *A. deplanchei* and *A. approximata* were synonyms, but Baly denied this. The species probably occurs neither in Australia nor New Guinea. Jacoby in commenting on it⁷ described some specimens from Somerset which he thought possibly belonged to the species, but which differed from the description in having the tips of the elytra pale, and the pygidium black. The species he identified was also standing in the Blackburn collection so named, and there are several close in appearance to it, but readily distinguished by the abdomen of the male.

A. analis Weber. Baly in commenting on the genus said⁸: "The first six species here described have simple antennæ in both sexes," *A. analis* being described as No. 1. Presuming Baly's identification to be correct, the species has no connection with *A. hilaris*, as identified in Australia, whose antennæ are not simple in the male. Moreover the nearest locality to Australia that he gives for the species is Celebes, so that it probably does not even occur in Australia. Allard's record of it from Adelaide was, no doubt, based upon *A. hilaris*.

A. armigera Baly. Described from a single female from Murray Island, a small island slightly more than one hundred miles east of Thursday Island. Four females from Roper River (Northern Territory), and one from St. Joseph's River (New Guinea) possibly belong to the species. The former appear like small ones of *A. abdominalis*, but have the pygidium ridged towards apex, with the apex itself produced as a small tooth of varying sharpness; one or two apical segments of the abdomen are more or less flavous, but only parts of the tibiæ and tarsi are infuscated, the femora being entirely pale. The one from New Guinea has the pygidium almost equilaterally triangular, with the tip produced as a short pointed process; its hind legs are black, middle ones not much paler, but front ones with only the tibiæ and tarsi slightly infuscated; the apical segment of its abdomen is semicircularly notched.

A. australis Blackb. After its description Blackburn incorrectly noted this name as a variety of *A. analis*, but later correctly as a synonym of *A. olivieri*.

A. borrei Baly. Proposed by Baly⁹ as a substitute for *A. pectoralis* Jac.

A. cartereti Guer. Recorded as from Carteret Harbour, New Holland, but really in the Solomons; so that the name should be expunged from Australian lists. Allard recorded it from New Holland with *A. instabilis* of Baly as a synonym; Baly denied the synonymy, but recorded the species from New Guinea. A female from the Madang district of New Guinea possibly belongs to the species. Its legs are entirely pale and under-surface pale except

⁷ Jacoby, Ann. Mus. Civ. Gen., 1886, p. 57.

⁸ Baly, loc. cit., 1888, p. 175.

⁹ Baly, loc. cit., 1889, p. 303.

that part of the abdomen is infuscated, but the upper surface of its pygidium is black. It is certainly close to some forms of *A. instabilis*, of which there are many specimens in the South Australian Museum from New Guinea.

A. cucullata Blackb. The only known species from Australia with the base only of the elytra black; the male (unknown to Blackburn) has simple antennæ, but the apical segment of its abdomen has a wide notch extending almost to its base.

A. cyanura Hope. The original description is "*Testacea, capite thoraceque maculatis elytrisque apicibus cyaneis*." Length $4\frac{1}{2} \times 2\frac{1}{4}$ lines. It is not referred to by Baly in the papers quoted, and Gemminger and Harold record it from Assam. The species, if it is really an *Aulacophora* (it was described as an *Auchenia*) probably does not occur in Australia. Allard states that it is a synonym of *Phyllobrotica lunata* Redt., an Asiatic species.

A. denticornis Blackb. Although Blackburn described the dark parts of the elytra as "rubropurpureis" and again as "purplish red," on a female (marked as a cotype) the elytral markings are almost black. On four specimens two of each sex, from Cairns, the markings are quite black. The abdomen of the male is somewhat as on the male of *A. hilaris*, but the part between the notches is wider, and the notches are narrower, although of about the same depth. Both sexes may be distinguished from those of *A. hilaris* by the apex of elytra being widely black, instead of just tipped with blackish.

A. duboulayi Baly. I have seen no specimens of this species, but the brassy-green elytra and male with the third to fifth joints of antennæ dilated should render it easy of recognition.

A. fallax Weise. Five specimens from the Cairns district appear to belong to this species; they have the general appearance of *A. borrei*, and the males have a similar trough-like abdominal cavity; but are distinguished by the tarsi and antennæ. On this species the basal joint of the front tarsi scarcely differs sexually—on that one the basal joint of the male is almost twice as large as that of the female. The antennæ are also conspicuously longer and thinner than those of *A. borrei*, and are pale throughout. On four specimens the labrum is entirely black, on one of the males it is infuscated only at the apex; the pale median fascia of the elytra is slightly larger than the black ones, but appears to have decidedly larger punctures. This, however, is due to "water-logging." The pale apical portion is not half the length of the fascia before it, and is narrowly continued around the sides. The black fasciæ are sometimes narrowly interrupted at the suture.

A. hilaris Boi. The original description is: "*Lutea, utrinque nigro bicincta*"; with a translation into French, the locality being noted as New Holland. Short as the description is it applies exactly only to the species subsequently named *A. olivieri* by Baly and *A. australis* by Blackburn. It has been (correctly, I think) applied to our most destructive species of the genus, with two large black spots on each elytron and the male with the third to fifth joints of

antennæ dilated and the following ones infuscated. The apical segment of its abdomen has a deep and not-very-narrow notch, extending on each side of the middle to near the base, the part between the notches shallowly depressed and the depression continued to the base itself. The basal spots on the elytra are narrowly separated at the suture, and the postmedian ones rather more widely there; the tip is also narrowly blackish. Allard, without giving evidence for his identifications, noted *A. nigrosignata* Baly, *A. pectoralis* Jac., and *A. insularis* Jac. as synonyms or probable synonyms; but Baly disagreed, apparently on good grounds, although he believed the type to be lost.

A. melanura Oliv. Recorded by Olivier from New Holland, by Boisduval from New Guinea, and by Allard from Borneo. It is described as a pale species with the elytra black except for parts of the lateral margins. It probably does not occur in Australia, or at least needs confirmation before being included in our lists.

A. nigrivestis Boi. Recorded by Boisduval as from New Holland. Baly in describing *A. lewisi*¹⁰ from China said it was possibly described from the female of *A. nigrivestis*. Subsequently¹¹ he extended the range of the species to India and the Malay Archipelago, but without again mentioning *A. nigrivestis*. Allard recorded *A. nigrivestis* from New Guinea, noting *A. lewisi* as a synonym. There are five specimens, from the Madang district of New Guinea, that appear to belong to the species. The elytra and abdomen are black in all of them. On two the metasternum is also black; on the others it is pale. The extent of infuscation of the hind legs varies. Its right to a position in Australian catalogues needs confirmation.

A. occipitalis Baly.¹² Blackburn of this species wrote¹³: "I have an example taken near Port Darwin which is quite identical with specimens of this species from New Guinea." In his collection there were two specimens, from Darwin and Cairns, standing as *A. occipitalis* and another from St. Joseph's River, New Guinea; the Darwin and New Guinea specimens are males, and agree with Baly's description of the abdomen, but their antennæ are very different from his description, the third to fifth joints being only slightly thicker than those of the female, instead of much wider and conspicuously and acutely produced on one side of apex. Numerous specimens from the Madang district of New Guinea agree perfectly with Baly's description, but the species occurs also at Somerset and Thursday Island. The species identified by Blackburn as *A. occipitalis* is here named *A. tetrastictoptera*.

A. olivieri Baly. The description of *A. olivieri* agrees perfectly with the species here regarded as *A. hilaris*.

A. palmerstoni Blackb. A synonym of *A. abdominalis*.

¹⁰ Baly, *loc. cit.*, 1886, p. 24.

¹¹ Baly, *loc. cit.*, 1888, p. 179.

¹² Baly, *loc. cit.*, p. 184.

¹³ Blackburn, *Trans. Roy. Soc. S. Aust.*, 1892, p. 237.

A. pectoralis Jac. As *A. pectoralis* was previously used by Chapuis. Baly altered Jacoby's name to *A. borrei*.

A. punctata Boi. The description of this species, "*Rubro lutea, tenuissime punctata, pectore pedibusque nigris*," may have been founded upon one of the varieties of *A. abdominalis*.

A. relictæ Boi. The description of this species reads as if founded upon *A. abdominalis*, some specimens of which have only the hind legs partly dark. Allard noted that *A. duvivieri* was a synonym of the species, which Baly, apparently with good reason, denied.

A. richmondensis Blackb. Allied to *A. hilaris*, but dark elytral markings not interrupted at the suture, the tips not dark, and abdomen entirely pale, and in the male with a deep median excavation. Although Blackburn wrote: "The antennæ are not different in the sexes," those of the male are slightly stouter than those of the female. Of the five specimens before me four have the metasternum black or blackish: on the other it is as pale as the abdomen. Blackburn considered it was distinct from *A. pectoralis* Jacoby (now *A. borrei* Baly) because Jacoby used the expression "the prothorax impunctate"; I believe it to be that species, however, because the prothorax from some directions appears almost impunctate, and Jacoby frequently noted species as having parts impunctate when small punctures are really present. Weise records the species from several fresh localities in Queensland under the following heading:—(CERATIA (ORTHAULACA) BORREI Baly (*pectoralis* Jac., *richmondensis* Blackb.).¹⁴

A. scutellata Boi. Allard considered this species was identical with *A. palustris* Perr. (which Baly states is a *Monolepta*) and *A. wallacei* Baly. It was reported from the Pacific Ocean by Boisduval, by Gemminger and Harold from Australia, and by Allard from Moreton Bay (no doubt Moreton Bay being intended). If really Australian the description "*Lutea, scutello nigro, abdomine pectoreque nigro-fuscis*" may well have been founded upon *A. wilsoni*, which occurs near Brisbane, as well as in New South Wales.

A. serena Weise. Referred by Weise to the subgenus *Orthaulaca* of *Ceratia*; the structure of its antennæ was not described, but they are apparently somewhat as in *A. hilaris*, from which, as from *A. tetrastictoptera*, the species should be distinct by its entirely pale abdomen, except for a spot on the pygidium.

A. wilsoni Baly. In general appearance like small *A. abdominalis*, but with the scutellum dark.

¹⁴ Weise, Arkiv för Zool., Stockholm, Band 15, No. 12, 1923, p. 86.

TABLE OF AUSTRALIAN SPECIES OF *AULACOPHORA*.

A ¹ . Elytra entirely pale.							
a ¹ . Scutellum dark	..	..	..	..	..	..	<i>wilsoni</i> Baly.
a ² . Scutellum pale.							
b ¹ . Pygidium acutely pointed	..	..	..	..	..	..	<i>armigera</i> Baly.
b ² . Pygidium less-acutely pointed	..	..	..	..	..	..	<i>abdominalis</i> Fab.
A ² . Elytra dark only at base	..	..	..	..	..	..	<i>cucullata</i> Blackb.
A ³ . Elytra with two black fasciæ or four large black spots.							
B ¹ . Antennæ of male with third to fifth joints wide and produced to one side							
c ¹ . Head with a large black spot on each side of base	..	..	..	..	..	..	<i>occipitalis</i> Baly.
c ² . Head immaculate.							
d ¹ . Apical third of elytra black	..	..	..	..	..	..	<i>denticornis</i> Blackb.
d ² . Apical third pale (the tip excepted)	..	..	..	..	..	..	<i>hilaris</i> Boi.
B ² . Antennæ simple in both sexes.							
C ¹ . Head with a large black spot on each side of base	..	..	..	..	..	..	<i>tetrastictoptera</i> Lea.
C ² . Head immaculate.							
D ¹ . Pygidium black	..	..	..	..	..	..	<i>apiciventrìs</i> Lea.
D ² . Pygidium pale.							
E ¹ . Apical segment of abdomen of male with space between notches transverse	..	..	..	..	..	..	<i>medioflava</i> Lea
E ² . Apical segment of male with two deep notches, the space between with a trough-like cavity almost to base							
F ¹ . Basal joint of front tarsi of male almost twice as wide as that of female, part of antennæ black	..	..	..	..	..	..	<i>borrei</i> Baly.
F ² . Basal joint similar in sexes, antennæ longer and thinner than in <i>A. borrei</i> , and entirely pale	..	..	..	..	..	..	<i>fallax</i> Weise.

Names not noted in above Table.

palmerstoni Blackb., *punctata* Boi., *relicta* Boi. (= *abdominalis* Fab.).

pectoralis Jac., *richmondensis* Blackb. (= *borrei* Baly).

australis Blackb., *olivieri* Baly (= *hilaris* Boi.).

scutellata Boi. (? = *wilsoni* Baly).

affinis Montr., *analís* Weber, *cartereti* Guer., *cyanura* Hope, *melanura* Oliv. (not Australian).

duboulayi Baly. Not tabled, as unknown to me; a new section "A⁴. Elytra entirely dark" would be required for it, to which *A. nigrivestis* Boi., if really Australian, could be added.

serena Weise. Not tabled, as unknown to me; it should probably be associated with *A. hilaris*.

AULACOPHORA TETRASTICTOPTERA sp. nov.

♂ Flavous; each side of base of head, four large spots on elytra, metasternum and much of abdomen black.

Head with a median line becoming foveate where it traverses the interocular groove. Antennæ scarcely passing the hind coxæ and fairly stout but simple. Prothorax with transverse impression deep and almost straight; with

dense and small punctures, larger about front angles than elsewhere. Elytra not transversely impressed near base, sides somewhat dilated from near base, punctures rather small but sharply defined. Apical segment of abdomen large, with a deep trough-like median cavity, bordered on each side, but not to its base, by a narrow groove. Length, 5.6-5 mm.

♀ Differs in having somewhat thinner antennæ, apical segment of abdomen smaller and simple, and its apex not notched.

Hab.—Northern Territory (Blackburn's collection), Darwin (W. K. Hunt), Roper River (N. B. Tindale); Queensland: Cairns district (Blackburn's collection and E. Allen); New Guinea: St. Joseph's River (Sir Wm. MacGregor). Type, I. 4068 in South Australian Museum; cotype, C.2751, in Queensland Museum.

In general appearance strikingly like *A. hilaris* and *A. occipitalis*, but at once distinguished by the simple antennæ of the male. On each of those species the third to fifth joints of the male are strongly dilated and produced to one side. The two large spots on each elytron are basal and postmedian, somewhat rounded and touch neither suture nor side; the tips are no darker than the adjacent surface but have a curious watery appearance. The basal segment of abdomen and parts of the second, and in the male the trough-like cavity are more or less flavous. The pygidium is black but normally concealed. On the elytra of some specimens the punctures, although really rather small, appear large, but this is due to "waterlogging."

AULACOPHORA MEDIOFLAVA sp. nov.

♂ Bright orange-flavous, median fascia of elytra paler; labrum, two wide elytral fasciæ and legs, except coxæ and knees, black; antennæ more or less deeply infuscated, some of the basal joints paler.

Head with a subfoveate expansion in middle of interocular groove. Antennæ long, thin, and simple. Prothorax with transverse impression wide and feebly curved; with small punctures, but becoming larger in all the angles. Elytra not transversely impressed near base; punctures small. Abdomen with a short incision on each side of apex, the space between them slightly depressed and about twice as wide as long. Length, 7.9 mm.

♀ Differs in being more robust, antennæ somewhat shorter, the apical segment of abdomen not incised and its tip gently rounded.

Hab.—Northern Queensland (Blackburn's collection), Cairns district (E. Allen, G. E. Bryant, and F. P. Dodd), South Johnstone River (H. W. Brown). Type, I. 4740, in South Australian Museum; cotype, C.2749, in Queensland Museum.

Larger than most of the Australian species and with the under-surface entirely pale. The abdominal incisions of the male are shorter than in the

allied species, and the space between them is but feebly concave. The basal fascia of the elytra occupies rather more than one-fourth of the surface, and is scarcely or not at all interrupted at the suture. The pale fascia is slightly longer, the following black one is about as long, and leaves a small apical portion pale (smaller and not incurved as on *A. borrei*), a narrower lateral portion, and usually the suture (very narrowly). The elytral punctures are really all small, but on some specimens, owing to "waterlogging," they appear of moderate size on the pale parts.

AULACOPHORA APICIVENTRIS sp. nov.

♂ Flavous; labrum, two wide elytral fasciæ, a spot on each side of apex of abdomen, pygidium and parts of legs black, most of antennæ infuscated.

Head with interocular groove narrow and curved, a small fovea in its middle. Antennæ long, thin and simple. Prothorax with transverse impression deep and slightly curved; punctures minute, but becoming of moderate size in front angles. Elytra moderately dilated posteriorly, not transversely depressed near base; punctures minute but rather sharply defined. Apical segment of abdomen rather large, a deep cavity commencing rather narrowly at base and dilated to apex, a narrow incision on each side of its apical two-thirds. Length, 6-8 mm.

♀ Differs in being somewhat more robust, antennæ somewhat shorter and less infuscated, apical segment of abdomen simple, its tip rounded, and the black part not interrupted in middle.

Hab.—Northern Queensland (Blackburn's collection), Cairns district (E. Allen and J. A. Anderson), Bowen (Aug. Simson). Type, I. 15645 in South Australian Museum; cotype, C.2750, in Queensland Museum.

The type was standing in the Blackburn Collection as *A. affinis*, apparently owing to Blackburn's acceptance of Jacoby's surmise; but *A. affinis* probably does not even occur in Australia, and in any case there are too many discrepancies from Montrouzier's description for this species to be treated as such. Except for a very small apical portion the elytra are divided into three zones of about equal extent, a flavous median one and two black ones. The hind legs are blackish except that the coxæ and knees are pale; the other legs have the femora entirely pale. The infuscation of the antennæ is not very deep; on one female the three median segments of abdomen are partly infuscated.

ON A COLLECTION OF SYRPHIDS FROM QUEENSLAND WITH DESCRIPTIONS OF A NEW GENUS AND OF EIGHT NEW SPECIES.

BY A. KLÖCKER, COPENHAGEN, DENMARK.*

(Plate X.)

THROUGH the kindness of Mr. Heber A. Longman, Director of the Queensland Museum, Brisbane, I got about two years ago an interesting collection of Syrphids from that country. They were collected by Mr. H. Hacker. During the long journey some specimens, however, were quite damaged, so that they could not be included in the following list.

PSILOTA Meigen.

Of this genus the collection contains at least four species, three of which are new to science. They are all wanting the vena spuria or it is extremely indistinct.

In the diagnosis of the genus, Meigen (System. Beschreib., III, 256, 1822) does not mention the vena spuria. In fig. 20 on plate 29 he figures the genotype, *Ps. anthracina* Meig., but no vena spuria is to be seen in that figure. As, however, it is also wanting in many other of Meigen's figures, where it ought to have been drawn, this circumstance is of no significance. Macquart (Hist. nat. des Ins., Dipt., Suites a Buffon, I, 1834) also gives a figure of this species, fig. 19, plate 12. Here the vena spuria is very prominent; but as generally his figures are more or less incorrect, we cannot rely upon this figure.† Williston (Synopsis. North Amer. Syrphids, 1886) says: "False vein obsolete," and Verrall (Brit. Flies, VIII, 1901): "Vena spuria very faint." I myself have not seen any specimen of *Ps. anthracina*.

1. PSILOTA VIRIDIS Macq.

Dipt. exot., Suppl. 2, 62, 1847, Pl. ii, fig. 12.

2 ♀♀; Brisbane, 26-9-1916 and 7-11-1917.

2. PSILOTA RUBRA n. sp.

♀. Eyes with short white hairs. Antennæ brownish, 3rd joint above blackish, somewhat elongate. Vertex and frons black with bluish tinge; the former with black, the latter with short white hairs and an indistinct longitudinal

* EDITOR'S NOTE.—I regret to state that Dr. A. Klöcker has passed away since this paper was written. This information was received in correspondence from Dr. K. L. Henricksen, of the Zoological Museum, Copenhagen.

† In the said fig. 19 the marginal crossvein goes directly to the margin of the wing, instead of going to the 3rd longitudinal vein and uniting with it.

furrow. Cheeks with whitish hairs. Mouth rather protruding. Thorax and scutellum bluish black; the latter with a distinctly marked, elevated margin. Abdomen red or yellowish red, with short white hairs. Front and middle legs yellow, except the two last joints of tarsi, which are brownish. Hind legs: femora rather thickened, below with somewhat strong short bristles; they are black, or only the distal half is black, the proximal half yellowish; tibiae somewhat curved, brownish; tarsi brownish, metatarsi dilated. Wings hyaline; stigma and the subcostal cell yellowish. The marginal crossvein and the 4th longitudinal vein are forming an obtuse angle, the top of which has a little spur. Alulae white, with very long marginal hairs. Halteres white. Long. 6-7 mm.

2 ♀♀; Brisbane, 12-9-1916 and 26-9-1916.

This species cannot be confounded with any other species on account of its red abdomen.

3. *PSILOTA TRISTIS* n. sp.

♀. Quite black with a faint bluish tinge. Eyes with not very long white hairs, especially on the lower two-thirds of the eye. Antennae: the first two joints black, the 3rd brownish black, somewhat elongate. Vertex and frons with blackish, rather short hairs, the latter with a faint longitudinal furrow. Face and cheeks with white hairs. Mouth much protruding. Thorax with short black hairs, especially on the front part, and with white hairs on the sides. Scutellum with a distinctly marked elevated margin with a few bristles. Abdomen with rather short greyish hairs, especially on the side margins. Legs black, the knees brownish; front and middle tibiae in the proximal half brownish. Hind femora only a little thickened, with short bristles below. Wings with a faint greyish tinge. The marginal crossvein as in *Ps. rubra*. Alulae white, halteres yellow. Long. 8 mm.

1 ♀; Brisbane, 26-9-1916.

It differs from *Ps. coerulea* Macq. in the colour of the abdomen, in having the two first joints of the antennae black (in *coerulea* they are "fauves"), and in the shape of the hind femora, about which Macquart in his description of *coerulea* says: "cuisses postérieures renflées, avec une échancrure près de la base."

4. *PSILOTA HIRTA* n. sp.

♀. Quite black, with a very faint dark bluish tinge. Eyes with long white hairs, especially on the lower half. Antennae blackish brown; the 3rd joint somewhat elongate. Vertex and frons with rather long blackish brown hairs; the latter with a very faint, almost not visible longitudinal furrow. Face blackish, greyish pruinose. Mouth rather protruding. Thorax with blackish brown hairs on dorsum and with white hairs on the sides. Scutellum with yellowish grey hairs. Abdomen densely pubescent of yellowish grey hairs, especially on the side margins, where they are more whitish. On the side margins of the 1st and 2nd segments the hairs are much longer. Femora blackish

with brown knees; front and middle tibiae and tarsi brownish; hind tibiae and tarsi blackish. The hairs on the legs whitish or greyish. Alulae whitish, halteres greyish. Wings with brownish tinge. Long. 8 mm.

1 ♀; Brisbane, 20-9-1916.

This very hairy species is easily distinguished by its brownish wings.

EMMYIA n. gen.

♂. Eyes strongly hairy. Eye suture at least three times as long as vertical triangle. 3rd joint of antennae about twice as long as broad. Frons not conically protruding (difference from *Pipiza*). Epistoma not hollowed below the antennae and without central knob. Front mouth edge only a little protruding. The upper marginal crossvein slightly curved and with the upper angle acute (difference from *Pipizella*). Middle crossvein before mediastinal vein; it is perpendicular on 3rd and 4th longitudinal vein and very near base of discal cell (the distance from base is as long as the length of the middle crossvein itself). Genitalia very small (difference from *Penium*). Middle coxae and hind trochanters without spine (difference from *Cnemodon*). Hind femora not thickened. Vena spuria rather distinct. The whole body densely haired.

Genotype: *Emmyia queenslandica*.

The genus belongs to the *Pipiza* group, and is chiefly agreeing with *Penium*.

5. EMMYIA QUEENSLANDICA n. sp. Fig. 1, Plate X.

♂. Eyes with very long pile; the hairs on the upper half greyish brown, on the lower half whitish. Antennae blackish; the 3rd joint somewhat elongate. Arista bare, a little longer than the 3rd joint, at the base of which it is inserted. Head broader than thorax. Vertical triangle rather little, with long black hairs; frons shining black in the middle and with very long black hairs here; on the sides with grey down. Epistoma and cheeks with grey down and longer hairs of the same colour; in the middle of the face from the antennae down to the mouth a blackish shining stripe; front parts of mouth and its environs shining black. Thorax and scutellum shining black, finely punctate, with long greyish hairs, especially on the sides and the margin of scutellum, which is distinctly marked and elevated. Abdomen black, punctate, shining; on the sides of 1st, 2nd and 3rd segment with long whitish hairs; on the sides of the following segments the hairs are mingled with darker ones; on dorsum all hairs are black, rather short, so that dorsum looks velvet black. Legs black, the knees and tibiae pitchy, with long and short white hairs. Hind femora not thickened. Alulae whitish, halteres yellow. Wings hyaline, with a faint brownish tinge on the costal part. Long. 10 mm.

1 ♂; Brisbane, 24-9-1918.

MELANOSTOMA Schiner.

6. MELANOSTOMA APICALE Big.

Annal. Soc. Entom. France, sér. 6, IV, 85, 1884.

2 ♂♂; Brisbane, 3-4-1917.

They agree perfectly with Bigot's description. He refers with doubt the species to *Melanostoma*, but there is no doubt about that it belongs to this genus. The species was hitherto only known from New Caledonia.

SYRPHUS Fabricius.

7. SYRPHUS VIRIDICEPS Macq.

Dipt. exot., Suppl. 2, 61, 1847.

4 ♂♂; Brisbane, 24-7-1914 and 10-10-1916.

Macquart's description is rather short; de Meijere has therefore (Tijdschr. v. Entom., LI, 299, 1908) given a supplement to it. Macquart says: "Pedibus fuscis, genubus flavis," de Meijere: "Vordere Beine gelb, die Schenkel an der Wurzel, die Vorderschenkel fast bis zur Mitte schwarz, auch die Tarsen dunkler, bräunlich, desgleichen die Vorderschienen oben an der Spitze. Hinterbeine schwarzbraun, die äusserste Spitze der Schenkel und die Schienenwurzel gelb." Thus, the two descriptions do not quite agree. In my specimens the two front and the two middle legs are yellow with the basal half of the femora black; for the rest as de Meijere says. According to this author the pile on thorax is yellow; in my specimens it is grey. For the rest the description agrees with my specimens, so I think they belong to this species.

8. SYRPHUS sp.

1 ♀; Brisbane, 10-3-1912.

I have not been able to identify this species.

9. SYRPHUS BALTEATUS de Geer, var. ALTERNANS Macq.

Dipt. exot. II, 2, 89, 7, 1842.

2 ♀♀; Brisbane, 19-4-1918.

SPÆROPHORIA St. Fargeau and Serville.

10. SPHAEROPHORIA KERTESZI n. sp.

♂. Antennæ yellow. Face yellow, sides somewhat opalescent; facial tubercle brownish; mouth parts brown. Thorax: dorsum shining greenish black, with very indistinct greyish longitudinal stripes on middle; the yellow side margins continuous to the scutellum; pleuræ whitish yellow. Scutellum yellow, with yellow hairs. Abdomen: 1st segment black, 2nd segment black, with a straight, broad, dark yellow transverse band, going close along the hind margin, only leaving a narrow black space. The other segments dark yellow or brownish yellow, brownish towards the end. Venter brownish yellow, darker behind. All legs light yellow, hind tarsi brownish. Wings somewhat greyish. Long. 7-9 mm.

The male genitalia rather small. Abdomen somewhat longer than the wings.

3 ♂♂; Brisbane, 15-11-1916.

I have pleasure in naming this species in honour of the famous Hungarian dipterologist Dr. Kertész.

XANTHOGRAMMA Schiner.

11. XANTHOGRAMMA GRANDICORNE Macq.

Dipt. exot., II, 2, 16. Pl. XVI, fig. 7, 1842.

4 ♀♀; Brisbane, 24-9-14 and 4-12-1918.

I have compared these specimens with two others in my collection from Hawaii, and they perfectly agree. Macquart's figure shows no facial tubercle at all, though he writes: "Face jaune, à proéminence peu distincte." He also figures the arista as being about 5 times as long as the 3rd antennal joint. A correct figure is found in Grimshaw: Fauna Hawaiiensis, III, 19, I, pl. II, fig. 7-10, 1901; he gives the profile of the head and a figure of the antenna with the arista inserted about in the middle of the 3rd joint and only half as long as this.

12. XANTHOGRAMMA sp.

1 ♀; Brisbane, without date.

The transverse yellow bands on abdomen are not interrupted in the middle. I have not been able to identify it.

ERISTALIS Latreille.

13. ERISTALIS AGNO Wlk.

List. Dipt. Brit. Mus., III, 630, 1849.

1 ♂; Brisbane, 26-12-1915.

14. ERISTALIS COPIOSA Wlk.

Insecta Saunders, Dipt., I, 249, 1852.

3 ♂♂; Brisbane, 15-9-1916, 16-9-1916, and 26-9-1916, and 1 ♀; Brisbane, 3-10-1916.

The habitat has hitherto been unknown, at any rate until 1909.

15. ERISTALIS FLAVOHIRTA n. sp. Fig. II.

♀. Eyes bare. Antennæ reddish; the 3rd joint suborbicular, brownish above. Arista bare, rather long. Head a little broader than thorax. Vertex black, with dense black pile, continued at each side along the eye margins. Frons with very short yellow hairs, among which long black erect hairs. Face with long whitish yellow hairs. Epistoma with a median black bare stripe, not hollowed below antennal tubercle; mouth not protruding. The hind margin of the head covered with dense yellow pile. Thorax velvet black, densely covered with short yellow hairs and somewhat longer black ones. Pleuræ with long yellowish hairs. Scutellum as thorax but with longer black hairs, especially on the margin, where they are bristle-like. Abdomen as long as head

and thorax together. The ground colour is velvet black. 1st segment with 2 small yellow spots, 1 at each front corner; 2nd segment with 2 great yellow triangular spots, only leaving the hind margin of the segment and an hour-glass shaped spot in the middle black; 3rd segment with 2 yellow subtriangular sidespots, going along the front margin almost until the middle, and along the two-thirds of the side margin, leaving the hind margin and a triangular spot in the middle of the segment black; 4th segment as the 3rd, but the spots are smaller; 5th segment quite yellow. Abdomen is covered with long yellow and black hairs, the former on the yellow parts, the latter on the black ones. The hairs are especially long at the front corners of the 2nd segment. The underside of thorax is black with yellow hairs, and the venter is yellow with long yellow hairs. Front legs: femora reddish with or without a brown base; tibiae dark brownish or blackish. Middle legs: femora yellowish, with long whitish hairs; tibiae brownish black or proximally reddish; tarsi brownish black. Hind legs: quite brownish black, or femora with reddish base, not thickened. The proximal half of the wings with a brownish tinge. Long. 8 mm.

2 ♀♀; the labels are marked: Hamlyn-Harris, Dunk Island, May 1914.

This species is a very characteristic one; head, thorax, and scutellum look as if they were powdered with yellow. The abdominal spots are of a bright lemon-yellow colour.

16. ERISTALIS HERVE-BAZINI n. sp. Fig. III.

♀. Eyes bare, with many small black points, which are confluent on the upmost part of the eye. Antennae reddish; 3rd joint suborbicular. Arista bare. Head as broad as thorax. Vertex black, with black pile. Frons with grey down and black pile; in the middle a velvet black, short, longitudinal narrow stripe; on each side a velvet black, triangular spot touching the inner eye margin and the upper end of the middle line. Antennal tubercle rather prominent. Face and cheeks with white down. Thorax grey; dorsum with 4 longitudinal opaque black stripes of about equal width; the two middle ones a little nearer to each other than the two lateral ones. Scutellum blackish brown or brown; the broad hind margin yellowish brown, with white pile. Abdomen about as long as thorax and scutellum together. 1st segment grey, the others opaque black with shining hind margins; 2nd segment with a transverse grey band, interrupted in the middle and dilated at the side margin; 3rd segment with 2 trapezoidal grey spots touching the front margin; 4th segment with 2 smaller spots of the same colour and shape; 5th segment with 2 very small spots of the same colour. Fore and middle legs: femora blackish with whitish tips; tibiae with proximal half whitish, distal half more or less blackish; tarsi with the two first joints yellowish white, the others blackish. Hind legs: femora blackish, the tip somewhat brownish; tibiae with the proximal half brownish with more or less whitish, and distal half or tip blackish; metatarsi whitish, the next joint a little darker, the others blackish. Wings

hyaline; veins brownish; stigma somewhat greyish, with a small black spot at each end, the proximal one being twice as large as the distal one. Long. 11-12 mm.

2 ♀♀; Brisbane, 3-10-1916 and 4-12-1918.

This very characteristic species, which belongs to the subgenus *Lathyrophthalmus* Mik. is easily distinguished from the related species by the shape and colour of the abdominal spots and the colour of the legs.

I have pleasure in naming this species in honour of the famous French dipterologist M. le prof. Hervé Bazin.

17. ERISTALIS PUNCTULATA Macq.

Dipt. exot., Suppl. 2, 59, 53, 1847.

1 ♀; Duaringa, June, 1917, and 1 ♀; Brisbane, 4-11-1914.

18. ERISTALIS TENAX L.

Syst. Nat., Ed. X, 591, 21, 1758.

1 ♀; Brisbane, 15-11-1918.

HELOPHILUS Meigen.

19. HELOPHILUS GRISEUS Wlk.

Entom. Magaz., II, 472, 1835.

1 ♂; Brisbane, 20-8-1918.

20. HELOPHILUS HILARIS Wlk.

List. Dipt. Brit. Mus., III, 605, 1849.

2 ♀♀; Brisbane, 15-11-1916 and 4-12-1918.

The habitat was hitherto, at any rate until 1909, unknown.

SYRITTA, St. Fargeau and Serville.

21. SYRITTA HACKERI n. sp. Fig. IV.

♂. Eyes facets small, larger in the front part of the eye. Antennæ yellow; 3rd joint ovate. Vertex bluish black, shining. Face almost straight, with whitish yellow down. Thorax blackish, at the front margin with 2 small greyish triangular spots; shoulders and sides pale yellow, the pale yellow extending into a small triangle on the dorsal side; 2 pale yellow, oblong spots at each side of the hind margin. Scutellum blackish, the hind margin a little paler. Abdomen on the dorsal side velvet black on segments 1, 2, and 3; 4th and 5th segments bluish black, shining. 1st segment on the sides below margin yellow; 2nd segment at each side along the side margin with a yellow sub-semicircular spot; on 3rd segment at each side a triangular yellow spot with the groundline on the front margin, where the spots are meeting each other in a point; 4th segment with a very narrow yellow hind margin. Fore and middle legs yellow, the latter with a little black marking at the proximal end of the femora. Hind femora very thick, with several shorter and longer

spines below, some of which are oblique; the femora are reddish, blackish at the tip. Hind tibiae bent at base in an obtuse angle and then curved, with a blunt projection on the inner side a little below middle; they are blackish with a broad reddish ring about in the middle. Hind tarsi brownish; 1st joint dilated. Wings shorter than abdomen; they are hyaline with a somewhat greyish tip. Stigma yellowish grey. Vena spuria very distinct. Long. 11.5 mm.

1 ♂; Brisbane, 12-11-1918.

I have named this species in honour of the entomologist, Mr. H. Hacker, who has collected the specimens named in this list.

22. SYRITTA ILLUCIDA Wlk.

Proc. Linn. Soc. London, IV, 121, 95, 1860.

2 ♂♂; Brisbane, 26-11-1912 and 15-11-1916.

It is with some doubt that I refer this species to *illucida* Wlk. Walker describes, i.e., only the female. My two specimens agree rather well with his description and I therefore identified them as this species. Later on I received from Dr. Kertész the male determined by him. In this specimen, the yellow brownish crossband on the abdomen is not interrupted as in the female. As both my specimens have this crossband interrupted, I am not sure what is the right. Perhaps the species may vary in this direction. I have not seen any description of the male.

S. illucida is known from Celebes and Formosa.

MICRODON Meigen.

23. MICRODON sp. (?).

1 ♂; Caloundra, November, 1912.

24. MICRODON sp. (?).

1 ♀; Stradbroke Island, 17-9-1915.

I have not been able to identify these species as they are rather worn.

Besides the above-named species there are also in the collection 2 *Psilota*, which are too much damaged to be identified or described, and a specimen without a head, which I cannot refer to genus.

Explanation of Plate X.

Fig. 1.—*Emmyia queenslandica* Klöcker. Head from side.

Fig. 2.—*Eristalis flavohirta* Klöcker. ♀ 1.—Head, thorax, and abdomen. 2.—Head from side.

Fig. 3.—*Eristalis Herve-Bazini* Klöcker. ♀ 1.—Thorax and abdomen. 2.—Head from side.

Fig. 4.—*Syritta Hackeri* Klöcker. ♂ 1.—Head, thorax, and abdomen. 2.—Head from side. 3.—Hind leg.



Fig. 1.

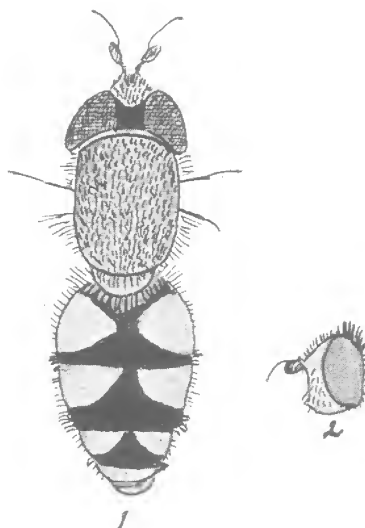


Fig. 2.



Fig. 3.



Fig. 4.



ICHTHYOLOGICAL ITEMS, No. 2.

BY ALLAN R. McCULLOCH, ZOOLOGIST, AUSTRALIAN MUSEUM.

(By permission of the Trustees of the Australian Museum.)

(Plates XI-XIV.)

Holotypes, Pleisotypes, Orthotypes, Lectotypes and Logotypes, and a whole array of other types, are terms of more or less exact meaning which have been established to meet the requirements of modern taxonomy. Some are ill-defined, and have been used only by the authors responsible for them, but others are gradually gaining wider acceptance as their value becomes more evident. In the "old days," types were things of elastic quality, one specimen or a dozen being inconsequently accepted as the basis of a species, regardless of their source, though they may have come from one or a dozen different localities. The exactitudes of Gill, Bleeker, and other forerunners of more methodical classification were disregarded by most ichthyologists of their day, and were often enough discountenanced as being unworthy of the consideration of naturalists. But with the ever-increasing accumulation of data the necessity for greater accuracy became apparent, and the designation of types demanded more careful consideration than had been previously afforded it.

As noted in the introduction of Part 1 of this paper (Mem. Qld. Mus. V., 1916, p. 58), an appreciation of the value of typical specimens of fishes deposited in the various Australian Museums has developed considerably within recent years, and the specimens upon which Castlenau, Macleay, De Vis, and Johnston founded their species have been segregated from the less valuable collections in which they were lost, and duly registered, labelled, and otherwise treated as befits their great importance. Too often the actual types have disappeared, some having decayed, while the identity of others has been lost for want of a label or some distinguishing mark. But improved conditions of these collections is steadily reducing the number of lost types, and the elimination of the comparatively few fishes described by Australian authors which remain known only by their names and ludicrously meagre descriptions is gradually approaching completion.

The following paper deals with several species of fishes which have been stumbling-blocks to all who have had occasion to consider them. I am indebted to the Committee of Management of the Macleay Museum for the loan of several holotypes of species of Carangids described by the late Sir William Macleay in the early eighties of last century, which have not been recognised by any later writers. These are here redescribed and figured. The rich collection of fishes in the Queensland Museum has been recently rearranged and classified by Mr. T. C. Marshall, to whom I am indebted for much help in the rediscovery of

types of specimens described by Messrs. De Vis and Ogilby, which, as noted in the following pages, have been so imperfectly labelled that their identification has been fraught with considerable uncertainty. Mr. H. A. Longman, as Director, has afforded me every assistance, and it is entirely due to his interest that I am able to submit these conclusions. Finally, I have had much valuable help from my assistant, Mr. G. P. Whitley, in the preparation of the figures and arrangement of the paper for press.

FAMILY MACRORHAMPHOSIDÆ.

MACRORHAMPHOSUS ELEVATUS Waite.

(Plate XI., fig. 1, and Text-figures 1-4.)

- Centriscus scolopax* Johnston, Proc. Roy. Soc. Tasm. 1882 (1883), p. 123, and 1890 (1891), p. 34. *Id.* Macleay, Proc. Linn. Soc. N. S. Wales ix., 1884, p. 42 (not *Balistes scolopax* Linné).
- Macrorhamphosus scolopax* var. *elevatus* Waite, Mem. Austr. Mus. iv. 1, 1899, p. 59, pl. vii., fig. 1. *Id.* Fowler, P. Acad. Philad. 1907 (1908), p. 425.
- Macrorhamphosus elevatus* McCulloch, Biol. Res. "Endeavour" i. 1, 1911, p. 23, fig. 8. *Id.* Regan, Ann. Mag. Nat. Hist. (8) xiii., 1914, pp. 17, 19.
- Centriscus scolopax* var. *elevatus* Kershaw, Vict. Nat. xxiii. 6, 1906, p. 125.
- Macrorhamphosus gallinago* Ogilby, Proc. Roy. Soc. Qld. xxi., 1908, p. 6.
- Macrorhamphosus lancifer* Ogilby, New Fish. Qld. Coast, 1910, p. 90.
- ? *Macrorhamphosus robustus* Ogilby, New Fish. Qld. Coast, 1910, p. 91.

Variation.—In my first report upon the fishes taken by the "Endeavour," I have referred to the great range of variation exhibited by a series of over 80 specimens of this common species. Large examples are always considerably deeper than smaller ones, but apart from a marked change of form which takes place as the fish increases in size, there is also much individual variation. This affects the relative proportions of the depth as compared with the length, and causes striking differences between two specimens of similar size. The accompanying figures illustrate the extent of this variation and depict one of the more slender and the deepest of my specimens, between which is an unbroken series of intermediate forms.

The length and position of the second dorsal spine is likewise variable, being longer than the head in some (Fig. 2), but little longer than the snout in others (Figs. 3-4) and shorter than it in one example. In deep specimens it is inserted midway between the hinder margin of the eye and the end of the middle caudal rays, but is farther forward in slender examples, being midway between the hinder orbital margin and the base of the tail.

Finally, the snout is much longer proportionally in some than in others.

The accompanying figures and tabulation of variable characters not only illustrate the remarkable range of variation, but also prove that specimens which have been described as separate species by Ogilby are really referable to the one species.

MACRORHAMPHOSUS ELEVATUS. MEASUREMENTS OF SELECTED SPECIMENS, SHOWING RANGE OF VARIATION.

Data of Specimen	Total Length.	Length to Hypural Joint.	Depth before Insertion of Ventral Fin.	Head.	Eye.	Post-orbital Part of Head.	Snout from Anterior Border of Eye.	Second Dorsal Spine from Basal Plate	Locality.
Lectotype of <i>elevatus</i> (Pl. XI., fig. 1)	141 mm.	125 mm.	39 mm.	60 mm.	10.5 mm.	8.5 mm.	40 mm.	45 mm.	Off Newcastle Bight, New South Wales; 28-40 faths.
? Holotype of <i>gallinago</i> (Text-fig. 1)	121	106	30	51	10.5	7.5	32	34	Tweed River Heads
? Holotype of <i>robustus</i> (Text-fig. 3)	150	134	45	59	11	10	38	40	Queensland
Holotype of <i>lancifer</i> (Text-fig. 2)	115	98	33	47	9	7.75	30	48	Off Cape Moreton, Queensland; 70-75 fathoms
Slender specimen here figured (Text-fig. 4)	97	86	21.5	40.5	7	6.5	27.5	30	Off Eden, New South Wales; 25-30 fathoms
"Thetis" specimen identified as <i>gallinago</i> by Ogilby	136	113	33.5	54	10	8	35	36.5	Off Broughton Island, New South Wales; 29-48 fath.
"Thetis" specimen figured in Biol. Res. Endeavour i. 1, 1911, p. 24	93	81	20	40	6.66	6½	27	27	Off Broughton Island, New South Wales; 29-48 fath.
"Thetis" smallest specimen	66	57.4	17.7	28.7	6	4.9	17.7	24.1	Off Cape Three Points, New South Wales; 32-40 faths.
Most slender specimen examined	81	71	16.5	34	6	6	22	18	Maroubra Bay, Sydney

An analysis of these proportions shows that the depth at the insertion of the ventral fin varies from 4.3 to 2.9 in the length to the hypural joint; the head is 2.0 to 2.1 in the same. The length of the second dorsal spine varies from 1.8 in the head in some specimens to others in which it is 0.9 longer than the head; and the snout is 1.4 to 1.6 in the head. The post-orbital portion of the head is 1.0 to 1.4 in the eye.

Synonymy.—The specimen characterised and figured by Waite as *Macrorhamphosus scolopax* var. *elevatus* was one of eleven trawled during the "Thetis" Expedition, 4–6 miles off Newcastle Bight, New South Wales, 28–40 fathoms; 2nd March, 1898. All were registered under one number, *I. 3970*, and marked "type" collectively, but only one corresponds in measurements and proportions with the figure. It has therefore been selected as the lectotype, and is again figured here (Pl. XI., fig. 1).

The name *M. gallinago* Ogilby, was based upon a specimen 123 mm. long from the Tweed River Heads, New South Wales. It was deposited in the

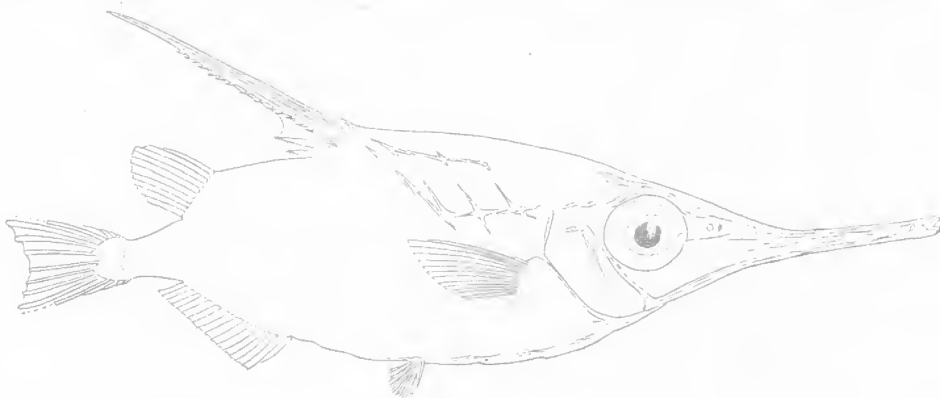


Fig. 1.—? Holotype of *M. gallinago* Ogilby, from Tweed River Heads, New South Wales; 121 mm. long.

collection of the Amateur Fishermen's Association of Queensland and entered in the Association's register by Ogilby as "No. 639 *Macrorhamphosus gallinago* Ogilby. Loc. Tweed Heads. Type." Mr. T. C. Marshall of the Queensland Museum recently searched through the A.F.A.Q. collection at my request, and found a bottle numbered 639, but labelled as "*M. elevatus*; loc. Tweed Heads." It contained three specimens of *Macrorhamphosus*, one of which corresponds in measurements and proportions with Ogilby's description of *M. gallinago*, and is evidently the holotype of that species. It is here figured (Text-fig. 1). I have already shown that *M. gallinago* is synonymous with *M. elevatus* (Biol. Res. Endeavour i. 1, p. 23). It may be noted that "the length of the body" in Ogilby's description is really the length from the end of the snout to the hypural joint; the length of the "trunk and tail" as measured by him excludes the caudal fin.

The description of *M. lancifer* Ogilby was prepared on board the trawler "Endeavour" "from a single specimen, 118 millim. long, taken in 73 fathoms on fine sand and mud, 36 miles S. 12° W. from Cape Moreton." The specimen was afterwards forwarded to the Australian Museum with the rest of the "Endeavour" collections and registered *E. 2971* and, though unlabelled, is readily identifiable by its length and locality. It is figured (Text-fig. 2). It must be noted that the position quoted by Ogilby is incorrect, the trawl being lowered north-east instead of south-west of Cape Moreton. Regan (*loc. cit.* 1914) has already suggested the identity of *M. lancifer* and *M. elevatus*, and I find no stable characters to distinguish them.

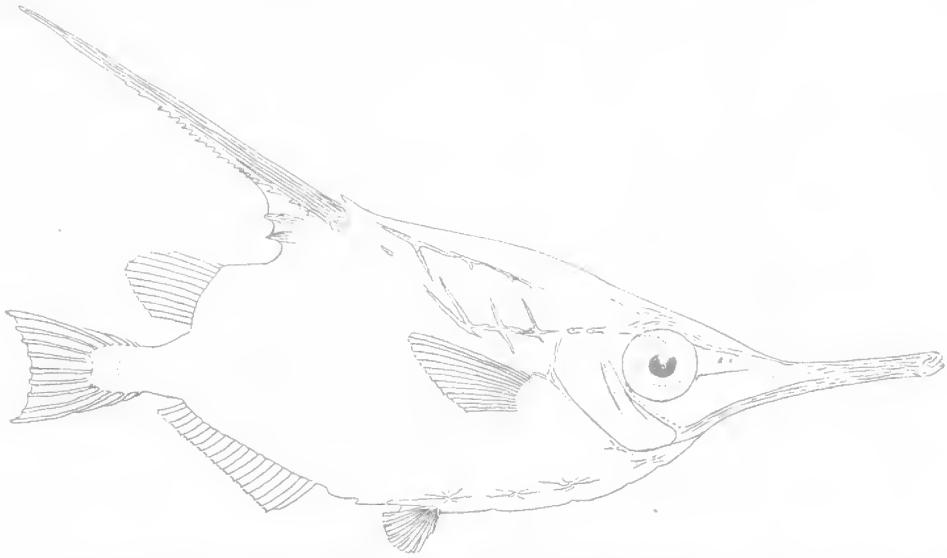


Fig. 2.—Holotype of *M. lancifer* Ogilby, from off Cape Moreton; 111 mm. long.

While describing *M. lancifer*, Ogilby established the "provisional" name *robustus* "for a Moreton Bay specimen, 6 in. long, characterised by its very stout and deep body," having the "depth of body 2·8 in its length." No specimen so labelled can now be found, but among the types of Ogilby's species which were deposited in the Queensland Museum by the Amateur Fishermen's Association of Queensland is an example registered *I. 1562*. This was entered in the register by Ogilby on 13th October, 1913, as *Macrorhamphosus*, but beyond stating that it was an A.F.A.Q. type he gave no other data as to species or locality. Though labelled by him later as *M. gallinago*, its proportions are very different to those of the *gallinago* form, and it cannot be the type of that species. It corresponds in a general way with the briefly characterised *M. robustus*, however, and may be reasonably regarded as the specimen upon which that name was based. It is figured in Text-fig. 3.

I agree with Regan that the name is merely referable to another variation of *M. elevatus*.

Distribution.—Southern Queensland, New South Wales, Victoria, and Tasmania. The specimens here figured are from the following localities:—

Plate XI., fig. 1.—4-6 miles off Newcastle Bight, New South Wales, 28-40 fathoms; 2nd March, 1898. Lectotype of *M. elevatus*.

Text-fig. 1.—Tweed River Heads, New South Wales. ? Holotype of *M. gallinago* Ogilby.

Text-fig. 2.—36 miles N.E. of Cape Moreton, Queensland, 70-75 fathoms; 3rd September, 1910. Holotype of *M. lancifer* Ogilby.

Text-fig. 3.—Queensland. ? Holotype of *M. robustus* Ogilby.

Text-fig. 4.—3-4 miles off Eden, New South Wales, 25-30 fathoms.

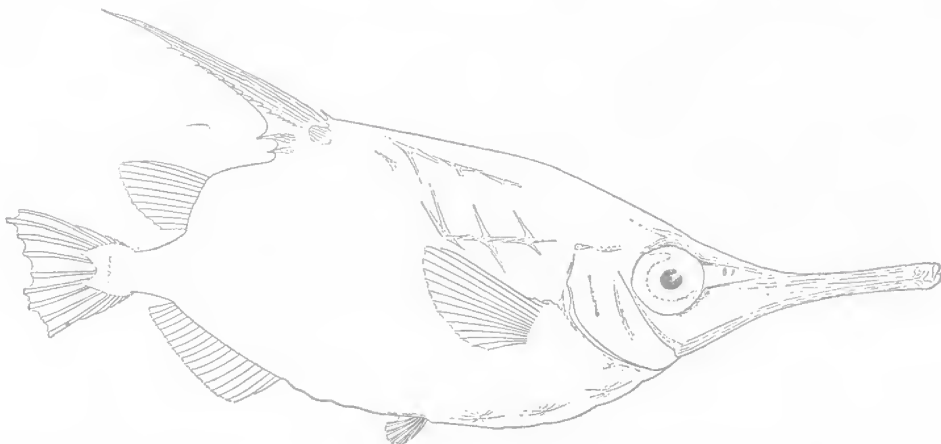


Fig. 3.—? Holotype of *M. robustus* Ogilby, from Queensland; 150 mm. long.

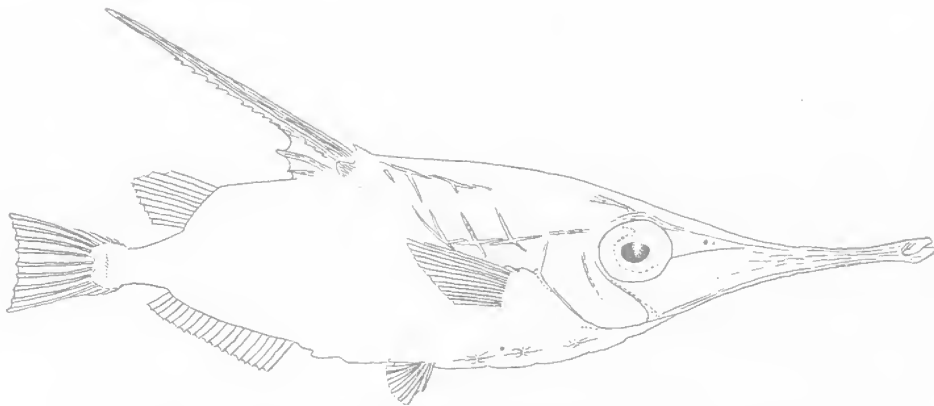


Fig. 4.—A specimen of *M. elevatus* from off Eden, New South Wales, 25-30 fathoms; 95 mm. long.

FAMILY CARANGIDÆ.

A valuable collection of fishes from the Pellew Group in the Gulf of Carpentaria has been made by Surgeon-Lieutenant W. E. J. Paradice, R.A.N., of H.M.A.S. "Geranium." It includes various genera and species of *Carangidæ*, the satisfactory identification of which has necessitated an examination of the typical specimens of several little-known species briefly described about 1882 by the late Sir William Macleay and Mr. C. W. De Vis. Some of these prove to be referable to the synonymy of other older species as detailed in the following pages, while the specific status of a few seems to be valid. They are herein redescribed and figured accordingly. A particularly interesting genus and species, *Ulva mandibularis*, hitherto known only from the typical specimens from Papua, was secured by Dr. Paradice in Australian waters for the first time, and is here redescribed and figured.

The status of various genera and subgenera grouped with the typical *Caranx* can only be determined by a monographic study of the family. They are therefore not considered in the following provisional key, which is merely a means of identifying the species so far known from Australian waters together with a few others from Papua.

Note.—Care is necessary in using this key, as the principal characters, the dentition, and the squamation of the breast are evidently somewhat variable with growth. Further their gradation from one type to another is so complete in the numerous species that some forms are intermediate between two sections, and can be placed almost equally well in either of two divisions.

1. Gill-rakers normal, not projecting forward into mouth. Lips normally rounded.

*a*¹. Teeth present on jaws and usually on vomer and palatines also.

*b*¹. A row of larger teeth along the front and sides of each jaw, which are exterior to and markedly different from the smaller depressible inner teeth, when those are present *Caranx*.

*c*¹. Breast wholly or partially naked.

*d*¹. Breast entirely naked before a line between the pectorals and the ventrals.

*e*¹. Straight portion of lateral line extending forward beyond the vertical of the origin of the second dorsal, and armed with strong scutes . . . *bucculentus*.

*d*². Breast partially naked ventrally.

*f*¹. A patch of scales before the ventral fins surrounded by a naked area; body deeper *ignobilis*.

*f*². Breast wholly naked on the ventral surface; general form more slender *papuensis*.

*c*². Breast entirely scaly.

*g*¹. Straight portion of lateral line much shorter than curved portion. A single row of teeth in each jaw.

*h*¹. Depth equal to or but little greater than length of head . . . *georgianus*.

*h*². Depth much greater than length of head . . . *platessa*.

*g*². Straight portion of lateral line longer than curved portion; upper jaw with an inner band of villiform teeth.

*i*¹. Maxillary reaching backward beyond vertical of anterior margin of eye; mandibular teeth in a single row . . . *forsteri*.

*i*². Maxillary not reaching vertical of anterior margin of eye . . . *valenciennæi*.

- b*². No outer row of larger teeth in the jaws, though some fixed conical teeth may be present exterior to the smaller inner depressible ones, if those are present.
- j*¹. Breast wholly or partially naked.
- k*¹. Breast entirely or largely naked before a line between the pectoral and ventral fins.
- l*¹. A band of teeth in each jaw; microscopic teeth on vomer and palatines.
- m*¹. Straight portion of lateral line shorter than curved part.
- n*¹. Depth between origin of first dorsal and ventrals greater than length of soft dorsal.
- o*¹. Anterior dorsal and anal rays longer than the bases of those fins.
- p*¹. Dorsal with 22-24 rays; anterior anal ray reaching beyond base of posterior ray *altissimus*.
- p*². Dorsal with 20-21 rays; anterior anal ray not reaching base of posterior ray *armatus*.
- o*². Anterior dorsal and anal rays shorter than the bases of those fins.
- q*¹. Eye shorter than postorbital portion of head *chrysophrys*.
- q*². Eye nearly as long as postorbital portion of head *malabaricus*.
- n*². Depth between origin of first dorsal and ventrals distinctly less than length of second dorsal *humerosus*.
- m*². Straight portion of lateral line longer than curved part *oblongus*.
- l*². Teeth in single rows on sides of jaws, in two rows anteriorly; straight portion of lateral line longer than curved portion *aurochs*.
- k*². Breast naked ventrally, but scales extend forward on the sides in advance of a line between the pectorals and ventrals.
- r*¹. Margins of second dorsal and anal fins more or less excised, the anterior rays longer than the others.
- s*¹. Scutes of lateral line confined to posterior third of its length, the anterior portion feebly arched; about 29 dorsal and 26 anal rays.
1. Anterior dorsal rays very elongate, produced into a falcate lobe; depth at origin of second dorsal less than half the length to middle of caudal peduncle, and equal to or less than length of second dorsal *ferdau*.
2. Anterior dorsal rays longer than the others but not produced into a falcate lobe; depth at origin of second dorsal equal to half the length to middle of caudal peduncle, and greater than length of second dorsal *laticaudis*.
- s*². Scutes of lateral line extending along posterior half of its length, the anterior portion distinctly arched; about 21 dorsal and 18 anal rays; broad bands of villiform teeth in the jaws, the outer series somewhat enlarged and widely set *gracilis*.
- r*². Margins of second dorsal and anal fins rounded, all the rays greatly produced *hullianus*.
- j*². Breast entirely or almost entirely scaly.
- l*¹. Abdominal profile markedly more deeply convex than the dorsal; eye longer than snout.
- u*¹. Body greatly compressed; lateral line armed with broad scutes; premaxillary teeth in two series, the outer tubercular, stout, and in a single row, the inner villiform and in a narrow band; mandibular teeth in a single row except anteriorly *kalla*.
(*C. parasitus* Garman apparently belongs to this section.)

- t*². Abdominal profile equally or less convex than the dorsal; eye shorter than snout.
- v*¹. Body stout, its depth subequal to the length of the head; teeth minute, curved, not juxtaposed *affinis*.
- v*². Body compressed, its depth greater than the length of the head.
- w*¹. Teeth in a single row, cardiform and juxtaposed; none of the dorsal and anal rays produced. (Palate toothless?.) *malam*.
- w*². Teeth minute, conical, not juxtaposed, in several rows anteriorly in premaxillaries, in single row on sides and on mandible. Many dorsal and anal rays produced into free filaments. Vomer and palatines with teeth *radiatus*.
- a*³. Teeth of jaws either lacking or infinitesimal *Gnathanodon*.
- y*¹. 19-21 dorsal and 16-17 anal rays. Palate toothless.
- z*¹. Depth at origin of second dorsal subequal to length of base of that fin *speciosus speciosus*.
- z*². Depth at origin of second dorsal greater than the length of the base of that fin *speciosus obtusiceps*.
- y*². 26-27 dorsal and 23 anal rays; palate with microscopic teeth; a dark blotch on shoulder *leptolepis*.
2. Gill-rakers very long and numerous, projecting forward into the mouth on each side of the tongue. Lips sharp-edged. Breast entirely naked before a line between the pectoral and ventral fins. A patch of microscopic teeth on the vomer, and a very narrow band on each palatine. Body greatly compressed, its profiles angular *Ulua*.
- 1^a. Depth at origin of second dorsal almost equal to half the length to the hypural joint; dorsal and anal rays produced *mandibularis*.

CARANX PAPUENSIS Alleyne & Macleay.

(Plate XIII.)

Caranx papuensis Alleyne & Macleay, Proc. Linn. Soc. N.S. Wales i. 4, 1877, p. 325, pl. x., fig. 3.

D. viii., i/22; A. ii., i/18; P. 21; V. i/5; C. 17.

Length to the end of the middle caudal rays, 136 mm. Depth at the origin of the second dorsal fin (49 mm.), 2·5 in the length to the hypural joint (124); head (37) 3·3 in the same. Eye (10) as long as the snout, and 3·7 in the head; interorbital space subequal to the width of the eye. Pectoral fin (47) 0·2 longer than the head.

Body greatly compressed and elevated. The upper profile from the snout to the caudal peduncle forms an even and very convex curve, which is much more arched than the lower profile. Hinder angle of the maxillary almost reaching the vertical of the middle of the eye; it is broad and obliquely truncate posteriorly, with a broad supplemental bone. Adipose eyelid broad posteriorly but not covering the pupil. Preopercular edge membranaceous, smooth and broadly rounded. Cheek, upper portion of operculum, and temporal region covered with small scales; the snout, interorbital space and a median area extending back to the origin of the first dorsal are naked.

Premaxillaries with an outer row of strong conical teeth which are largest anteriorly and become smaller backward; an inner band of villiform

teeth on each side. Mandibular teeth in a single row, and much smaller than those of the outer series of the premaxillaries. A small patch of teeth on the vomer and a band of minute ones on each palatine; the roof of the mouth and the tongue also bear many patches of microscopic teeth. Eighteen slender gill-rakers on the first gill-arch, of which those at the posterior angle are half as long as the eye.

Body covered with scales of moderate size which extend forward on the sides to the isthmus, but leave the ventral surface of the breast naked; this naked area is sharply defined on each side, and is broadest just before the ventral fins, becoming narrower anteriorly. A few scales implanted in advance of the ventral fins suggest that this area has been denuded, though no scale-pits can be traced on the naked area. A low scaly sheath covering the bases of the dorsal and anal fins. Lateral line strongly arched anteriorly, becoming straight below the eighth dorsal ray and well before the middle of its length; the whole of the straight portion is armed with scutes, which increase in size backward to the caudal peduncle, where they cover about two-thirds of its width.

Dorsal spines slender, imperfect in the type, the third a little shorter than the postorbital portion of the head. Anterior dorsal rays imperfect, but elevated into a high lobe. Anal produced into a falcate lobe anteriorly and preceded by two strong spines. Pectoral falcate, reaching beyond the angle of the lateral line. Ventrals inserted below the pectorals. Caudal deeply forked.

Colouration.—Silvery, darker on the back.

Described and figured from the holotype in the Macleay Museum. It differs from Macleay's description in having the breast naked instead of scaly but as noted above this may have been denuded. A second specimen in the Australian Museum from the Solomon Islands has the breast similarly naked but, apart from this character, both are quite similar to *C. forsteri* with which *C. papuensis* may prove to be identical.

Macleay recorded that he had two specimens, the largest 6 inches long. This last is the specimen here described and figured. The other is also preserved in the Macleay Museum, and is only a couple of inches long; it is apparently referable to *C. forsteri*.

Locality.—Hall Sound, Papua.

CARANX MELAMPYGUS (Cuv. & Val. ?) Gunther.

(Plate XI. ; Fig. 2.)

Caranx melampygus Cuvier & Valenciennes, Hist. Nat. Poiss. ix., 1833, p. 116.

Caranx stellatus Edoux & Souleyet, Voy. Bonite, Poiss., 1841, p. 167, pl. iii., fig. 2. *Id.* Jordan & Jordan, Mem. Carnegie Mus. x. 1, 1922, p. 40.

Caranx melampygus Gunther, Fishe Sudsee v., 1876, p. 133, pl. lxxxvi. *Id.* Macleay, Proc. Linn. Soc. N. S. Wales vii., 1882, p. 355.

Carangus melampygus Jordan & Evermann, Bull. U.S. Fish. Comm. xxiii. i., 1905, p. 192, fig. 73.

? *Caranx moresbiensis* Macleay, Proc. Linn. Soc. N. S. Wales vii., 1882, p. 358.

D. viii., i/23; A. ii., i/19; P. 20; V. i/5; C. 17.

Length to end of middle caudal rays 203 mm. Depth at the origin of the second dorsal (71 mm.) 2.6 in the length to the hypural joint (188); head (57) 3.2 in the same. Eye (12) 1.6 in the snout (20); interorbital space (15) 3.8 in the head. First dorsal ray (41) 1.3 in the head. Pectoral fin (68) 0.1 longer than the head.

Body much compressed; upper profile from the snout to the origin of the first dorsal strongly arched and keeled and much more convex than the lower, which forms an oblique line from the isthmus to the origin of the anal. Hinder angle of the maxillary reaching the vertical of the anterior third of the eye; it is obliquely truncate posteriorly with a broad supplementary bone. Adipose eyelid broad posteriorly but not covering the pupil. Preopercular edge membranous, finely crenulate, its hinder margin subvertical and the angle broadly rounded. Cheek, upper portion of operculum and temporal region with small scales; the snout, interorbital space and a median area extending backward to the origin of the first dorsal naked.

Premaxillaries with a row of strong conical teeth and a narrow band of small villiform ones. Mandible with a row of strong teeth on each side which are smaller than those of the premaxillaries; no inner band of smaller teeth. A small triangular patch of minute teeth on the vomer and a broad band on each palatine; a band extends along the median line of the tongue. Eighteen gill-rakers on the lower limb of the first gill-arch; those at the posterior angle more than half as long as the eye.

Body covered with scales of moderate size which almost completely cover the breast, leaving only a tiny patch near the isthmus bare. Bases of the pectoral fins naked; the dorsal and anal fins have scaly sheaths covering the basal portions of their anterior rays. Lateral line strongly arched to below the anterior dorsal rays, the arched part being 1.4 in the length of the posterior straight portion; almost all of the posterior part is armed with scutes which increase in size backward to the caudal peduncle, where they are equal to about two-thirds of its width. An oblique keel on each side of the base of the tail.

Dorsal spines slender, the third highest and but little shorter than the length of the postorbital portion of the head. Anterior dorsal rays produced into a falciform lobe. Anal similar to the dorsal. Ventrals inserted slightly behind the vertical of the bases of the pectorals. Pectorals falcate, reaching well beyond the angle of the lateral line. Caudal deeply forked.

Colouration.—Silvery after long preservation in alcohol, the upper half darker.

Described and figured from a specimen in the Macleay Museum collection. It is labelled as *C. moresbyensis* Macleay (Proc. Linn. Soc. N. S. Wales vii., 1882, p. 358), and being the only specimen in the collection bearing that name, was supposed to be the holotype of the species. According to Macleay's meagre description, however, the type was only two inches long, so although this

specimen agrees in a general way with *C. moresbyensis* as characterised, it affords no reliable evidence to determine the true status of that species.

Locality.—Port Moresby, Papua.

CARANX LEPTOLEPIS Cuvier & Valenciennes.

(Text-fig. 5-6.)

Caranx leptolepis Cuvier & Valenciennes, Hist. Nat. Poiss. ix., 1833, p. 63. *Id.* Gunther, Brit. Mus. Cat. Fish. ii., 1860, p. 440. *Id.* Day, Fish. India, 1878, p. 225, pl. li., fig. 4. *Id.* McCulloch, Biol. Res. "Endeavour" iii. 3, 1915, p. 129, pl. xxi.

Caranx cheverti Macleay, Proc. Linn. Soc. N. S. Wales i., 1877, p. 324, pl. x., fig. 1.

Caranx procaranx De Vis, Proc. Linn. Soc. N. S. Wales ix., 1884, p. 540.

Synonymy.—As already shown,¹ *Caranx cheverti* Macleay is synonymous with *C. leptolepis*. The holotype, here illustrated (Fig. 5), has been borrowed from the Macleay Museum for the purpose. It is 138 mm. long to the end of the middle caudal rays and exhibits the following characters:—

D. viii., i/25; A. ii., i/22; V. i/5; P. 18; C. 17.

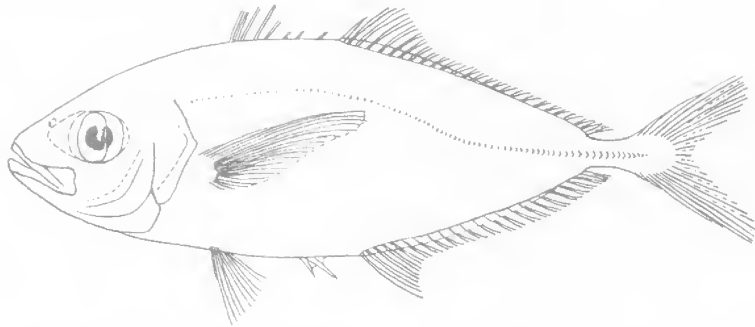


Fig. 5.—*Caranx leptolepis*. Holotype of *C. cheverti* Alleyne & Macleay, from Katow, New Guinea.

Depth at origin of second dorsal (43 mm.) 2.9 in the length to the hypural joint (127); head (37) 3.4 in the same. Eye (11) as long as its distance from the end of the snout, 3.3 in the head.

Body entirely covered with small scales which extend over the breast. Straight portion of the lateral line a little shorter than the curved part, armed with about 23 scutes which merge into the scales anteriorly; broadest scutes are scarcely one-third of the width of the caudal peduncle. Jaws practically toothless; a very few microscopic teeth are present near the mandibular symphysis, and two occur at widely spaced intervals on one side of the lower jaw; premaxillaries, vomer and palatines toothless. A broad adipose eyelid posteriorly and a narrow anterior one. The sides are silvery and the back dark, the junction of the two sharply defined. A large round spot below the commencement of the lateral line and extending over the end of the operculum.

¹ McCulloch, Biol. Res. "Endeavour" iii. 3, 1915, p. 130.

I am indebted to Mr. H. A. Longman, Director of the Queensland Museum, for the loan of the holotype of *Caranx procaranx* De Vis (Fig. 6). This specimen is 80.5 mm. long to the hypural joint, and is in a somewhat dilapidated condition, but having compared it with specimens of *C. leptolepis* I find it agrees in all details. It has the following characters:—D. vii. (?), i/26; A. ii, 2/23; V. i/5; P. 20; C. 17.

Depth at origin of second dorsal (28 mm.) 2.8 in the length to the hypural joint (80.5); head (23.5) 3.4 in the same. Eye (7.5) 0.1 longer than the snout (6.5), and 3.1 in the head.

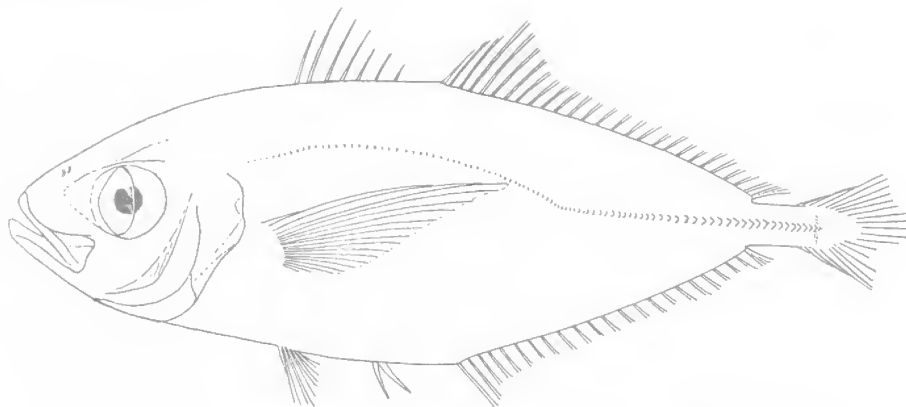


Fig. 6.—*Caranx leptolepis*. Holotype of *C. procaranx* De Vis, from Cape York, Queensland.

The body has been entirely covered with small scales, which extended over the breast. Straight portion of the lateral line a little shorter than the curved part, and armed with about 25 narrow scutes which merge into the scales anteriorly; the broadest scutes are less than one-third as wide as the caudal peduncle. A few microscopic teeth are present near the symphysis of the premaxillaries; the rest of the jaws, vomer and palatines are toothless. A broad adipose eyelid posteriorly, and a narrower one anteriorly. The sides are largely silvery with a dark area on the back sharply defined; a dark blotch on the end of the operculum apparently extends onto the shoulder.

This specimen differs from De Vis' description in several important details, but there can be no doubt that it is his actual holotype, and that the discrepancies are due to the usual inaccuracies common to his descriptions. He described the lateral line as "armed throughout, but the plates of the curved portion are smaller than those of the straight." The specimen shows that the scales of the lateral line are adherent, whereas they have been lost from both sides of it, and the so-called armature of the greater portion consists merely of ordinary scales. The larger scales which he described as irregularly scattered among the smaller ones are merely a few which have remained adherent, and appear conspicuous and large among the scale-pits which cover the greater portion of the body.

Localities.—*Caranx leptolepis* is, so far, known in Australia only from Queensland waters. The holotype of *C. chererti* was collected at Katow, New Guinea, while that of *C. procaranx* was taken at Cape York.

CARANX LATICAUDIS Alleyne & Macleay.

(Plate XII.)

Caranx laticaudis Alleyne & Macleay, Proc. Linn. Soc. N. S. Wales i., 1877, p. 325, pl. x., fig. 2.

D. viii., 1/29; A. i., 1/26; P. 1/22; V. i/5; C. 17.

Length to the end of the middle caudal rays, 262 mm. Depth at the origin of the second dorsal (116 mm.) 2.06 in the length to the hypural joint (240); head (68) 3.5 in the same. Eye (15) 1.3 in the snout (20); interorbital space (23) 2.9 in the head. Pectoral fin (92) 0.3 longer than the head.

Body much compressed; the upper profile from the snout to the origin of the second dorsal is sharply keeled and is more strongly arched than the lower, which forms an oblique line from the chin to the origin of the anal. Hinder angle of the maxillary just reaching the vertical of the anterior border of the eye; it is obliquely truncate posteriorly, with a large supplemental bone above it. Adipose eyelid forming a narrow rim which encircles the eye. Preopercular edge finely crenulate, its hinder margin vertical and the angle broadly rounded. Cheek, operculum and temporal regions largely covered with small scales; the snout, interorbital space, and a narrow median area extending backward to the origin of the first dorsal are naked.

Premaxillaries with a band of small teeth on each side, which is broadest anteriorly and becomes narrower as it extends backward; a few of the outer teeth are a little larger than the others, conical, and fixed, but there are no caniniform teeth. Mandible with a narrow band of small teeth on each side, the outer ones larger than the others. A broad patch of minute teeth on the vomer, a narrow band on each palatine, and others on the tongue. Eighteen gill-rakers on the first gill-arch, those at the angle about half as long as the eye.

Body covered with very small scales, but the breast in advance of the ventral fins is naked; this naked area is restricted to the ventral surface posteriorly, but it becomes broader and extends a little way up the sides anteriorly. The bases of the pectoral fins are naked; the dorsal and anal fins have broad scaly sheaths covering the basal portions of their rays. Lateral line feebly arched anteriorly, becoming straight at the tips of the pectoral fins, and behind the middle of its length. About one-fourth of the lateral line is armed with scutes, which are well developed on the caudal peduncle, but become rapidly smaller and merge into the other scales well behind the point where the straight portion commences to arch forward.

Dorsal spines weak, the fourth highest and about as long as the eye;

the eighth spine is much stouter than the others, and stands isolated between the two dorsal fins. Anterior dorsal rays damaged but apparently shorter than the postorbital portion of the head; they form a short angular projection but not a falciform lobe. Anal produced into a falcate lobe anteriorly, the first ray much longer than the postorbital portion of the head; a single weak and isolated spine precedes the anal fin. Pectoral falcate. Ventrals inserted well behind the pectorals, but a little before the vertical of the first dorsal spine; the spine is slender and much shorter than the first ray. Caudal broadly forked.

Colouration silvery after long preservation in alcohol, the back darker.

Described and figured from the unique holotype in the Macleay Museum. It differs from Macleay's brief description in having 29 instead of 26 dorsal rays, but its authenticity is beyond doubt.

This species is very close to *C. ferdau* Forskal, but the only specimen known differs from the figures and descriptions of that species in having a deeper body, and in lacking the anterior falcate lobe of the second dorsal. It resembles *ferdau* in its dentition, squamation, form of the lateral line, large number of dorsal and anal rays, and weak anal spines, and clearly belongs to the same subdivision of *Caranx* as that species.

Locality.—Hall Sound, near Yule Island, Papua; collected by Sir William Macleay during his expedition to New Guinea in 1875 in the "Chevert."

ULUA MANDIBULARIS Macleay.

(Plate XIV.)

Caranx mandibularis Macleay, Proc. Linn. Soc. N. S. Wales viii., 1883, p. 356.

Ulua mandibularis McCulloch, Biol. Res. "Endeavour" iii. 3, 1915, p. 140.

D. vii., 1/20; A. ii., 1/17; V. i/5; P. 20; C. 17. About 20 scutes on the lateral line.

Length to the end of the middle caudal rays 256 mm. Depth at the origin of the second dorsal (114 mm.) 2.1 in the length to the hypural joint (241); head, excluding the mandible (70), 3.4 in the same. Eye (20) as long as the snout, and 3.5 in the head; interorbital width (18) but little less than the length of the eye. Pectoral fin (103) 0.4, and first dorsal ray (95) 0.3 longer than the head; first anal ray (63) 1.1 in the head.

Body greatly compressed; the upper profile from the snout to the origin of the second dorsal sharply keeled and markedly convex on the nape and slightly concave on the snout; it is more arched than the lower profile. Mandible broad and compressed, the chin projecting, forming an obtuse angle in advance of the upper jaw. Hinder angle of the maxillary reaching the vertical of the anterior margin of the pupil; it is obliquely truncate posteriorly, with a

moderately broad supplemental bone. Adipose eyelid forming a narrow rim which encircles the eye. Preopercular border entire and broadly rounded. Part of the cheek, the upper part of the operculum and a small area on the temporal region are scaly; the remainder of the head and a narrow median area extending backward to the first dorsal spine are naked.

A single row of microscopic teeth in the upper and lower jaws, and a patch on the vomer; palatines apparently toothless. Lips sharp edged. Gill-rakers very long, projecting forward in the mouth, almost to the level of the vomer; there are fifty on the lower limb of the first gill-arch, and those at the hinder angle are about three-fourths as long as the eye.

Body covered with small scales, but the whole breast in advance of an oblique line from behind the ventral rays to the lower base of the pectoral is naked; the bases of the pectoral fins are also naked. Dorsal and anal fins with broad scaly sheaths covering the anterior three-fourths of their lengths. Lateral line strongly arched anteriorly, becoming straight below the ninth dorsal ray and a trifle in advance of the middle of its length. There are about 20 scutes which are strong on the caudal peduncle but decrease rapidly in size forward and merge into the scales anteriorly on the straight portion. Two oblique ridges on each side of the base of the tail.

Dorsal spines weak, the third highest and scarcely longer than the eye; sixth spine minute, the seventh stronger and isolated in advance of the second dorsal. Anterior ray greatly produced, the four following successively shorter; the remainder subequal in length. Anal similar to the dorsal but with the anterior rays shorter. Pectoral strongly falcate, reaching backward beyond the middle of the dorsal and anal fins. Ventral small, with very weak spines, reaching backward half their distance from the anal. Caudal deeply forked.

Colouration.—Olive-green above, silver below; the junction of the two colours sharply defined above the middle line of the body. The edges of the caudal and anal blackish, the inner axil of the pectoral black.

Described and figured from a specimen, 256 mm. long, from the premaxillary symphysis to the end of the middle caudal rays.

Macleay has described the head as free of scales, but there are really numerous small scales on the cheeks and upper parts of the opercles.

Affinities.—The two typical specimens of this species are preserved in the Macleay Museum, and a co-type is in the Australian Museum. They are very similar to the figure of *U. richardsonii*² but have the frontal profile a little more convex, the eye larger, and a few more anal rays.

Locality.—Sir Edward Pellew Islands Group, Gulf of Carpentaria; coll. Dr. W. E. J. Partridge, R.A.N., June, 1923. This genus and species has not been hitherto recognised from Australian waters, the types from near Port Moresby being the only specimens previously recorded.

² Jordan and Snyder.—Mem. Carnegie Mus. iv., pt. 2, 1908, p. 39, pl. liii.

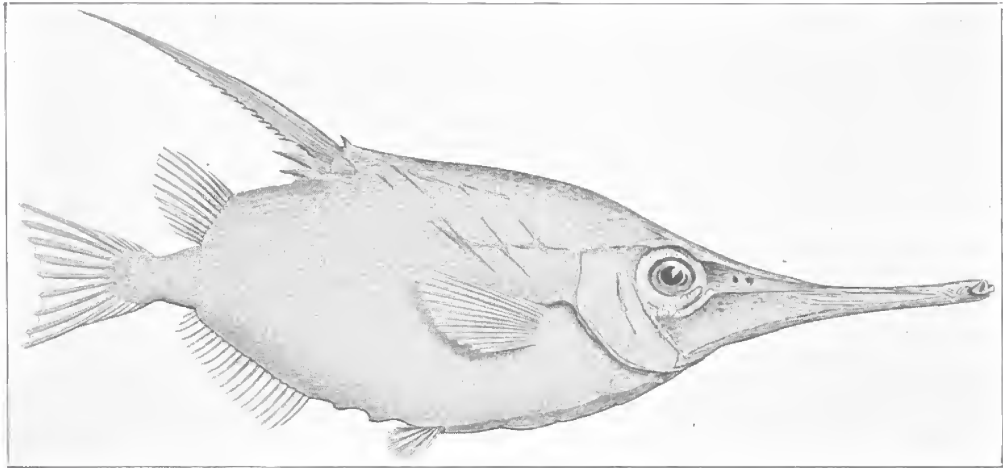


Fig. 1.—Lectotype of *Macrorhamphosus elevatus*, from Newcastle Bight. 140 mm. long.

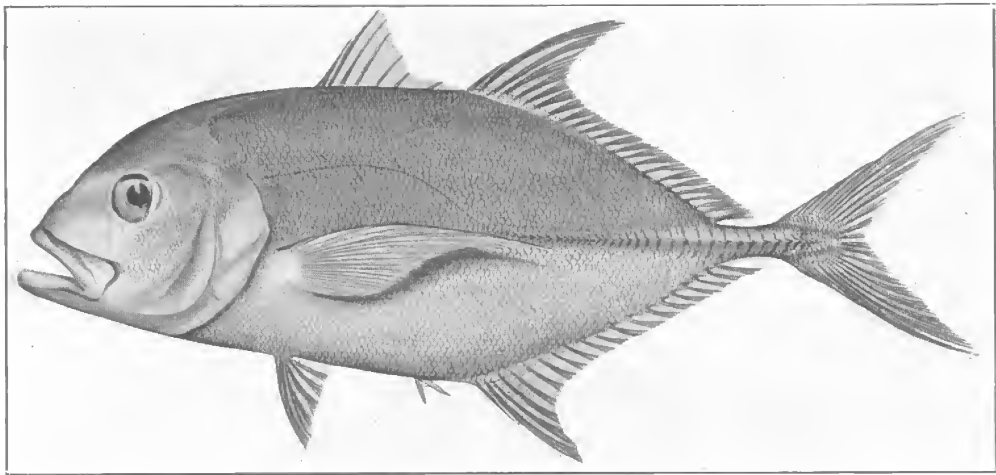


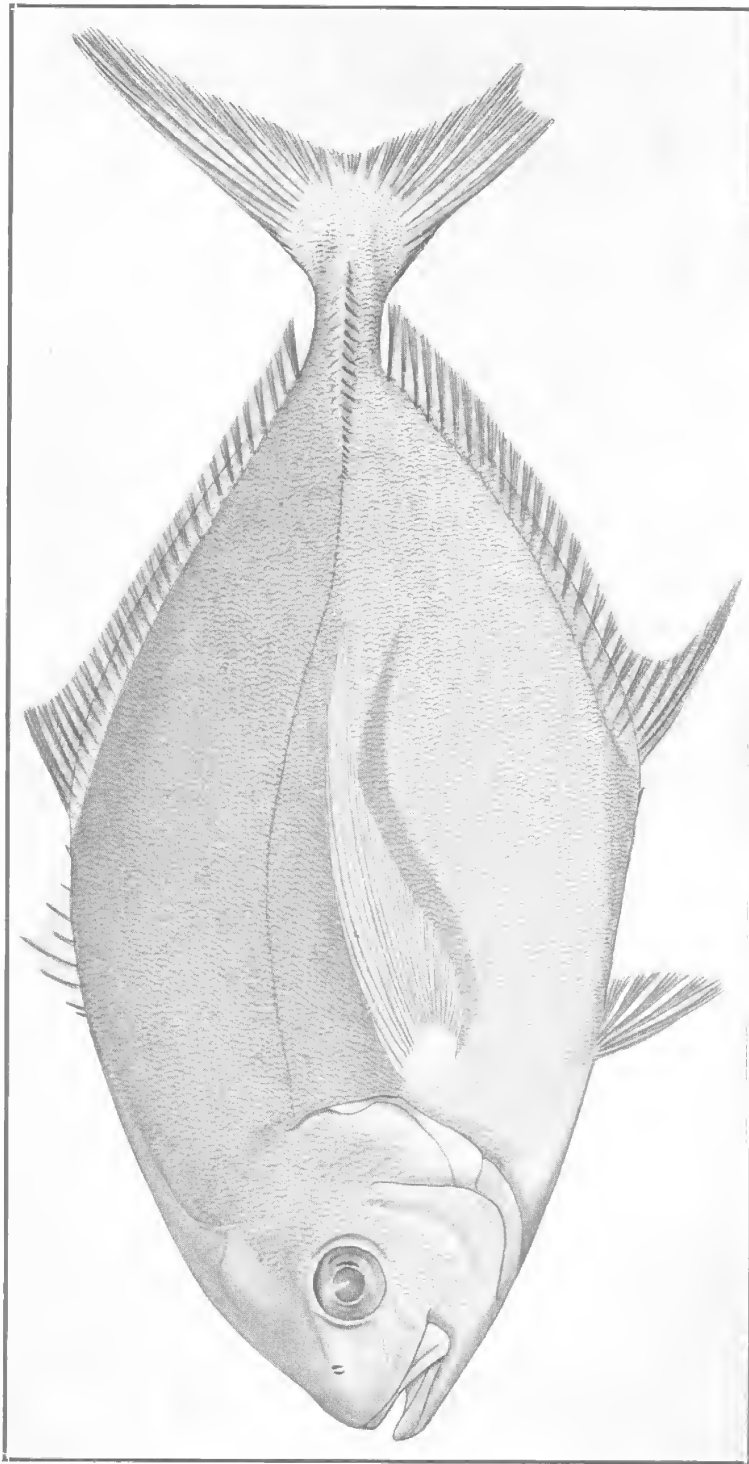
Fig. 2.—*Caranx melampygus* Cuvier & Valenciennes.

A specimen, 203 mm. long to the end of the middle caudal rays, from Port Moresby, Papua.

A. R. McCulloch, del.

Face page 76.



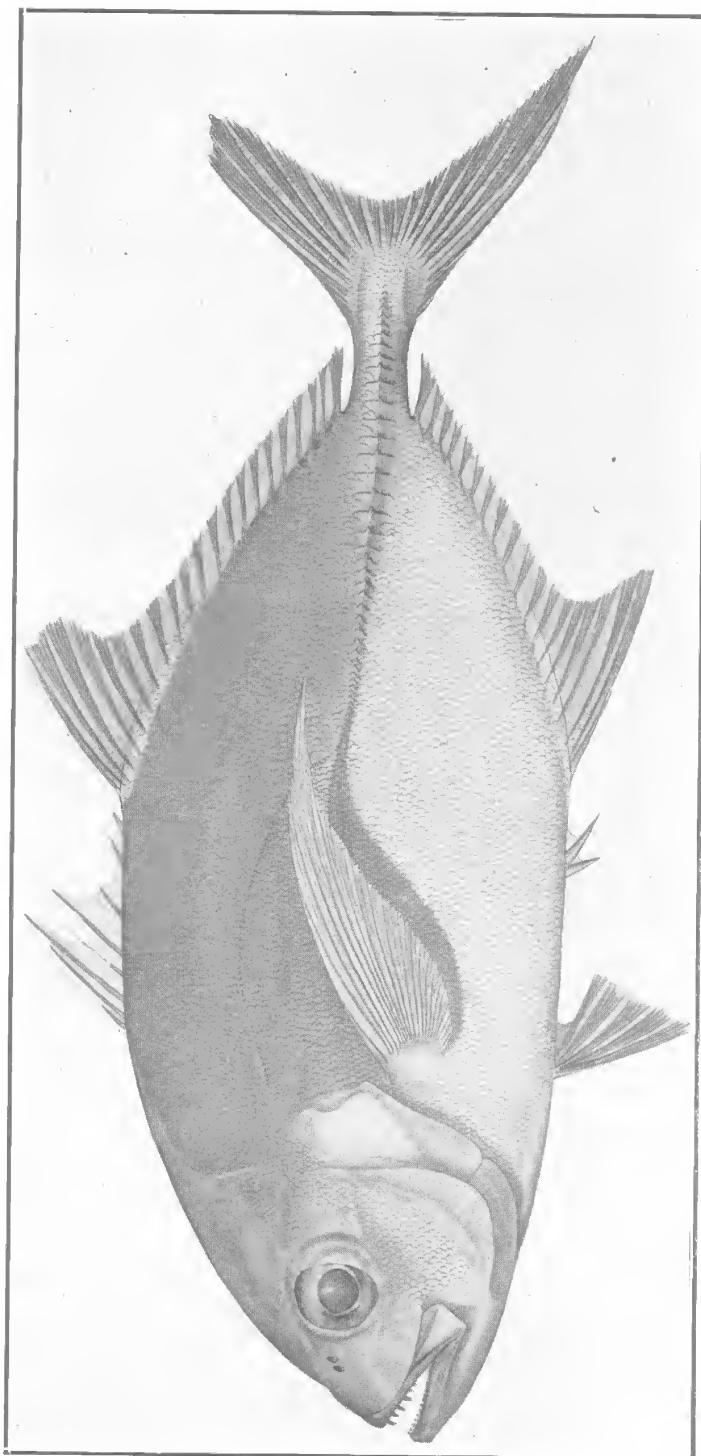


CARANX LATICAUDIS Alleyne & Macleay.

Holotype, 262 mm. long to the end of the middle caudal rays, from Hall Sound, Papua.

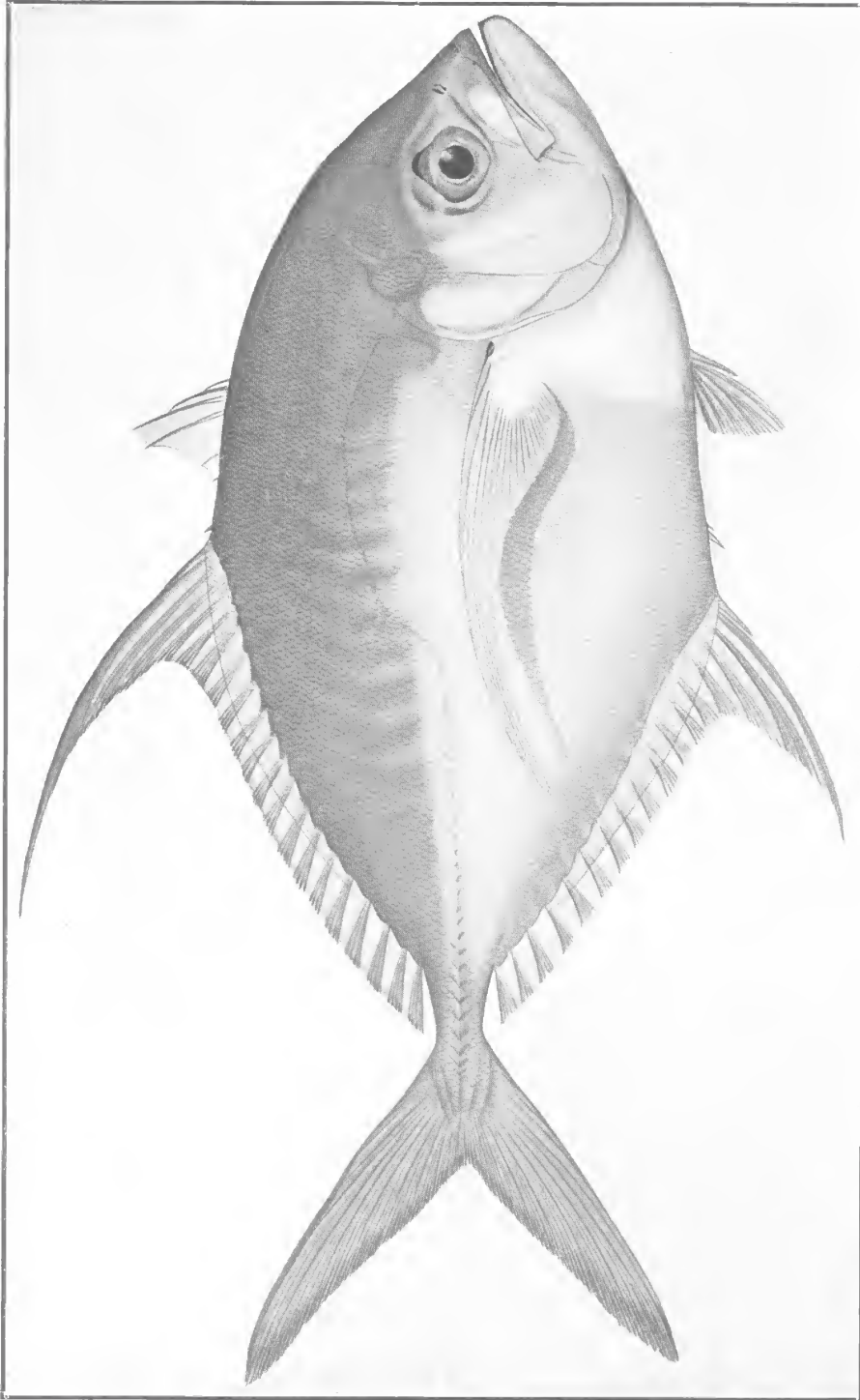
A. R. McCulloch, del.





CARANX PAPUENSIS Alleyne & Macleay.
Holotype, 136 mm. long to the end of the middle caudal rays, from Hall Sound, Papua.
A. R. McCulloch, del.





ULUA MANDIBULARIS Macleay.

A specimen 256 mm. long to the end of the middle caudal rays, from Sir Edward Pellew Islands Group, Gulf of Carpentaria.

A. R. McCulloch, *del.*



ON FOSSIL PLANTS FROM BELLEVUE, NEAR ESK.

By A. B. WALKOM, D.Sc., HONORARY PALÆOBOTANIST, QUEENSLAND MUSEUM,
SECRETARY OF THE LINNEAN SOCIETY OF NEW SOUTH WALES.

(Plates XV.-XXI. ; Text-figures 1-3.)

WELL-PRESERVED specimens of fossil plants from Bellevue Station, a few miles easterly from Esk, on the Upper Brisbane River, were recently brought under the notice of the Queensland Museum by His Excellency the Governor of Queensland, Sir Matthew Nathan. The specimens were from among a collection made by Mrs. Lumley Hill, to whose enthusiasm in increasing this material the Museum owes a splendid series of fossil plants from this locality. From the variety of species represented and their apparent abundance, it seems certain that, with further systematic collecting, the horizon would rival that of Denmark Hill, Ipswich, as possibly the best-known locality for fossil plants in Queensland.

The collection itself is of more than ordinary interest, containing as it does a number of forms which have not previously been recorded from Mesozoic rocks in Queensland.

Since the last descriptions of fossil plants from the Esk district were published (Q'land Geol. Survey, Publications 252, 257, 259) two papers have appeared which deal more or less directly with the flora.

J. H. Reid, in a note on the Walloon Jurassic Flora (Proc. Roy. Soc. Qld., xxxiv., 1922 [1923], 168-170), would appear to record changes in the range and distribution of *Thinnfeldia* and *Tæniopteris*. The paper, however, seems merely to anticipate the correlation of the Esk Series with the Ipswich Series instead of with the Walloon Series, and to call attention to the modifications in the range of the species of these genera necessitated by this change. No new facts appear to be presented, and the distribution of these genera, as regards the Series in which they have been found, remains unaltered.

J. H. Reid and C. C. Morton (Geology of Country between Esk and Ipswich, Qland. Govt. Mining Journ., Jan. 1923, 7-14) propose the correlation of the Esk Series (comprising the Esk shales and Bellevue conglomerates) with the Ipswich Series, and also recognise the presence of an underlying series, the Borallon Series, outcropping between the Esk Series and the Brisbane Schist Series. The Esk and Ipswich Series are placed as Upper Triassic and the Borallon as Lower (?) Triassic. Provisional lists of the fossil plants are given, but as they are only, for the most part, generic determinations, they are of no value for detailed correlation. The evidence for placing the Borallon Series

so low in the Triassic appears to be the fact that there is "a well-marked unconformity," revealed by the strikes and dips, between the Borallon and Esk Series; at the same time it is stated that the fossils so far found by these authors are "also common to both the Ipswich and Esk Series."

The collection here described from the neighbourhood of Bellevue contains the following species:—*Neocalamites hoerensis*, *Schizoneura* cf. *africana*, *Schizoneura* sp. a, *Cladophlebis australis*, *C. lobifolia*, *Thinnfeldia Feistmanteli*, *T. lancifolia*, *Dictyophyllum rugosum*, *Pecopteris* (? *Asterotheca*) *Hillæ*, n. sp., *Tæniopteris* (? *Danæopsis*) *crassinervis*, *T. Carruthersi*, *T. Tenison-Woodsi*, *Sphenopteris superba*, *S. pecten*, ? *Nilssonina superba*, n. sp., *Pterophyllum Nathani*, n. sp., *Pseudoctenis eathiensis*, *Podozamites lanceolatus*, *Ginkgoites digitata*, *G. sibirica*, *Ginkgoites* sp., *Baiera bidens*, *B. Simmondsi*, Gymnospermous seeds, *Phænicopsis elongatus*.

The species which had previously been described from the Esk district are:—*Schizoneura* sp. a, *Cladophlebis australis*, *Dictyophyllum Davidi*, *Hausmannia Buchii*, *Thinnfeldia Feistmanteli*, *T. odontopteroides*, *T. lancifolia*, *Tæniopteris Tenison-Woodsi*, *T. Carruthersi*, *T. crassinervis*, *Stenopteris elongata*, *Ginkgo* cf. *magnifolia*, *Baiera Simmondsi*, *Pterophyllum abnorme*, *T. contiguum*, *T. Nathorsti*, *Pseudoctenis eathiensis*, *Otozamites Queenslandi*, *Taxites planus*, *Phænicopsis elongatus*.

Of this latter list of twenty species, ten had also been found in the Ipswich Series, but eight of the others were confined to the Esk Beds and this, combined with the fact that very little field work had been done in the area, made it difficult to correlate the Esk beds with the Ipswich or Walloon Series with any degree of certainty. They were correlated with the Walloon Series mainly on the presence of coniferous types which were not known from the Ipswich Series.

As a result of further field work since 1918, by officers of the Queensland Geological Survey, the Esk Series have been correlated on stratigraphical grounds with the Ipswich Series. The evidence presented by the increased number of species of fossil plants confirms this proposed correlation. The additions to the fossil flora of the Esk district described here comprise *Neocalamites hoerensis*, *Schizoneura* cf. *africana*, *Cladophlebis lobifolia*, *Dictyophyllum rugosum*, *Pecopteris* (? *Asterotheca*) *Hillæ*, n. sp., *Sphenopteris superba*, *S. pecten*, (? *Nilssonina*) *superba*, n. sp., *Pterophyllum Nathani*, n. sp., ? *Podozamites lanceolatus*, *Ginkgoites digitata*, *G. sibirica*, *Ginkgoites* sp., *Baiera bidens*, Gymnospermous seeds.

Of the thirteen determinable species in this list, three (*Pecopteris Hillæ*, ? *Nilssonina superba*, and *Pterophyllum Nathani*) are new, three others (*Cladophlebis lobifolia*, *Sphenopteris pecten*, and *Ginkgoites sibirica*) are new to the Queensland fossil flora, and six others had previously only been described from the Ipswich Series.

Of the thirty-three determinable species now known from the Esk district, sixteen occur in the Ipswich Series.

Such species as *Pecopteris* (? *Asterotheca*) *Hillæ* and *Tæniopteris* (? *Danæopsis*) *crassinervis* point to a Rhætic age for the Esk Series, thus confirming the correlation of this Series with the Ipswich Series, for which a Rhætic age is indicated both by the fossil plants and insects.

It is not proposed to put forward here a critical analysis of the flora of the Esk Series, in view of the fact that the collections are still being added to (thanks to the enthusiasm of Mrs. Lumley Hill); also I have in hand for examination a series collected by Messrs. Reid and Morton in the district. Amongst these collections there are so far very few specimens from the Series which Reid and Morton have called the Borallon Series, and it is hoped that, before the whole flora is analysed, further specimens may be available for comparison with Lower Triassic floras.

EQUISETALES.

NEOCALAMITES HOERENSIS (Schimper).

(Plate XV., fig. 1.)

(See Q'land Geol. Surv., Pub. 252, 1915, p. 33, pl. 2, fig. 1.)

Specimen *F. 1485* is a good example of this species, which has previously been described from Denmark Hill, Ipswich (Walkom, 1915, p. 33).

The stem impression is 1.5 cm. wide, the nodes being about 3 cm. apart; in portion of the specimen the stem is coarsely ridged longitudinally, the ridges being about 1.5 mm. apart. The leaves are long and narrow (12 cm. long by 1.5-2 mm. wide) and are not very numerous.

One of the chief points of difference between this species and *N. Carrerei* is that in the latter the number of leaves in a whorl is considerably greater.

Locality.—Portion 32, Parish of Northbrook. (*F. 1485*.)

SCHIZONEURA cf. AFRICANA Feistm.

(Text-fig. 1.)

(See Q'land Geol. Surv., Pub. 252, 1915, p. 35, Pl. 3, fig. 1.)

In 1915 I referred a specimen from the Ipswich Series at Ebbw Vale to this species. In the present collection there are specimens which confirm my previous determination.

The stem is about 1.5 cm. in diameter, jointed, with the leaves in whorls at the nodes. There are about 5 leaves in a whorl, each nearly 1 cm. wide and more than 7 cm. long, traversed by 3-5 parallel veins. The leaf

becomes split along these veins, and gives the appearance of several very long thin leaves. The leaves are preserved along the bedding planes of the rock, the stem being perpendicular to the bedding.

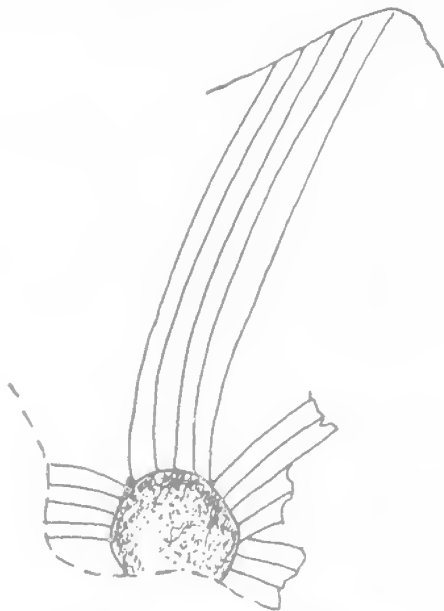


Fig. 1.—*Schizoneura cf. africana*
Feistmantel.

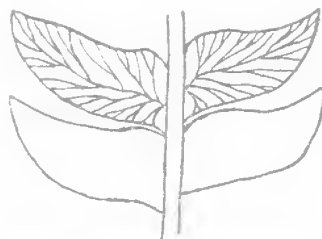


Fig. 2.—*Cladophlebis lobifolia*
(Phillips). ($\times 2$)

The specimens show very close similarity to that figured by Seward (1908, p. 89) from the Beaufort Series of South Africa, assigned to a Permian horizon.

Locality.—Portion 74, Parish Wivenhoe. (*F.* 1539.)

SCHIZONEURA sp. *a* Seward.

(Plate XVI.)

(See Q'land Geol. Surv., Pub. 252, 1915, p. 36.)

Pith casts of Equisetaceous stems appear to be abundant on the horizon from which these fossils were obtained. They are of a type similar to those described as *Schizoneura* sp. *a* from South Africa (Seward, 1908, p. 86) and Queensland (Walkom, 1915, p. 36).

The stems are in some cases more than .75 m. (2 ft. 6 in.) long, 5 cm. wide, with internodes 8-9 cm. long. They are finely ridged, with about 17 ridges per cm. of breadth.

One specimen (*F.* 1487*a*) shows the basal end of a branch about 5 cm. in diameter.

Associated with some of these stems are what appear to be broad linear leaves, up to 2.5 cm. wide, traversed by few (up to 6) parallel veins, between which are fine parallel striations. Some of these leaves are so distributed that they appear to have their origin at the nodes of the stems, and should further specimens show this to be the case the reference of the pith casts to the genus *Schizoneura* will receive confirmation.

Localities.—Portions 74 (*F. 1533*—Plate XVI.) and 42, Parish of Wivenhoe (*F. 1554*).

FILICALES. OSMUNDACEÆ (?)

CLADOPHLEBIS AUSTRALIS (Morris).

(Plate XVII., fig. 1, E.)

(See Q'land Geol. Surv., Pub. 257, 1917, p. 3.)

Large fronds of this very common Mesozoic species are present in the collection. They do not differ from typical examples previously described and figured from the Ipswich and Walloon Series.

Locality.—Portion 32, Parish of Northbrook (*F. 1542*).

CLADOPHLEBIS LOBIFOLIA (Phillips).

(Plate XV., Fig. 2; Text-fig. 2.)

(For full synonymy see Seward, 1900, p. 145.)

Specimens from Bellevue differ from any species of *Cladophlebis* previously described from Queensland and correspond closely with figured examples of *C. lobifolia* from other parts of the world.

The frond is bipinnate, the pinnae being long, linear, narrow, opposite or alternate; the pinnules are short, closely set, obtusely pointed, subopposite, generally with a lobe on the upper margin near the base. The venation is alethopteroid.

Localities.—Portion 24, Parish of Esk (*F. 1544*); Portion 42, Parish of Wivenhoe (*F. 1473*).

THINNFELDIEÆ.

THINNFELDIA FEISTMANTELI Johnston.

(Plate XVII., fig. 1, F.)

Good examples of this common species are in the collections from Bellevue. The species has been recorded in Queensland from the Ipswich Series in the Ipswich district, and from Kilcoy Range and 5 miles north of Esk. It has a wide distribution outside Queensland in rocks of Lower Mesozoic age.

For full reference to the synonymy and a discussion of the species see Queensland Geological Survey Publication 257, p. 17.

A small fragment on specimen *F. 1472* shows the structure of the rachis previously noted (Walkom, 1917, p. 19).

Locality.—Portion 42, Parish Wivenhoe (*F. 1468*).

THINNFELDIA LANCIFOLIA (Morris).

(Plate XV., fig. 3.)

(See Q'land Geol. Surv., Pub. 257, 1917, p. 21, Pl. 3, 4, 7.)

Specimens belonging to this species from the Esk district are in general of a somewhat more robust type than those previously described from Queensland. They do not, however, differ from typical examples of the species.

One specimen (*F. 1583*) shows a certain amount of the cell structure (probably of the cuticle) preserved as a silicified film. Similar specimens to this have been under examination for some time past from the Queensland Geological Survey collections from the Ipswich Series at Denmark Hill.

Locality.—Portion 42, Parish Wivenhoe (*F. 1472*); Portion 24, Parish Esk (*F. 1546*).

DIPTERIDINÆ.

DICTYOPHYLLUM RUGOSUM L. & H.

(Plate XXI., fig. 1.)

(See Q'land Geol. Surv., Pub. 257, 1917, p. 9, Pl. 4, 6, 9.)

Specimen *F. 1468* shows portion of a frond with five pinnæ, and is the most complete example of a frond of this species yet recorded from Queensland. The pinnæ are 10 cm. or more in length and up to 2.5 cm. wide; they are deeply divided into segments in their distal portions.

Locality.—Portion 42, Parish Wivenhoe (*F. 1468*).

(?) MARATTIALES.

PECOPTERIS (? ASTEROTHECA) HILLÆ, n. sp.

(Plate XVII., figs. 1, 2, and 3.)

Frond bi- (? tri-) pinnate; ultimate pinnæ long, narrow, parallel-sided; pinnules not quite at right angles to rachis, to which they are attached by the whole base, margins parallel, apices bluntly rounded, base slightly expanded. Midrib distinct; secondary veins few, simple, almost at right angles to midrib.

Fertile pinnæ (Plate XVII., fig. 3; *B* enlarged) differ in shape from sterile (Plate XVII., fig. 2; *A* enlarged) only in the pinnules being somewhat narrower and more pointed.

Sori (or synangia) contiguous, .5 to .75 mm. in diameter, in a row parallel to the margin of the pinnule, and composed usually of 4 sporangia. Further details of structure of sori and sporangia not determinable.

Ultimate pinnæ are up to 4 cm. long and 6-10 mm. broad.

The pinnules are 1.5 to 2 mm. broad and up to 4.5 mm. long, and have from 5 to 7 simple veins from each side of the midrib. In the sterile specimens none of these secondary veins branch as described by Zeiller (1903, p. 26) in *P. (Asterotheca) Cottoni* from the Rhætic of Tonkin. In the fertile pinnules there are from 10 to 14 sori on each pinnule.

The present species shows closest resemblances to *Pecopteris (Ptychocarpus) unila* Brongn., a species common in the Upper Coal Measures of England, and to *Pecopteris (Asterotheca) Cottoni* Zeiller from the Rhætic of Tonkin. It is not as completely known as the former, from which it differs certainly in the number of sporangia in the synangia, and also in the pinnules being always, as far as known, separate, not confluent for part of their length. The venation is apparently similar to that of *P. unila* and the size of the pinnules is approximately the same.

Pecopteris (Asterotheca) Cottoni is a larger species than ours and differs from it in the venation, the secondary veins in the Tonkin species branching once and sometimes a second time. Fertile examples of these two species, apart from differences in size, are very similar to one another.

To which genus of those with the *Pecopteris* type of foliage the present specimens belong, it will not be possible to determine definitely until examples are found with the synangia in a better state of preservation. They show a considerable degree of resemblance both to *Ptychocarpus* and *Asterotheca*, being apparently somewhat closer to the latter, in which the sporangia in a synangium are usually less in number than in the former and are also less closely united to one another (Scott, 1908, p. 279).

Ptychocarpus has been found only in Carboniferous Coal Measures, while *Asterotheca*, also an Upper Palæozoic genus, persists "in the Triassic and even Rhætic beds" (Scott, 1908, p. 350). *Pecopteris (Asterotheca) Cottoni* Zeiller occurs in the Rhætic beds of Tonkin.

Zeiller (1903, p. 26) placed *Scoleopteris australis* Shirley (1898, p. 17, Pl. 12) as a synonym of his *Pecopteris Cottoni* from Tonkin. It appears, however, that Shirley's specimens were more probably fertile examples of the species *Cladophlebis australis* (see Walkom, 1917, p. 3), and there was certainly not sufficient evidence preserved to allow them to be referred to *Scoleopteris*.

Both *Ptychocarpus* and *Asterotheca*, the two genera to which our specimens show most resemblance, belong to the Marattiales and it seems reasonable to place *P. Hillæ* as a member of this group.

No specimens similar to those now described have been recorded from

Australian Mesozoic rocks, and this species is named in honour of Mrs. Lumley Hill, whose enthusiasm is responsible for the collection of this valuable fossil plant material from the neighbourhood of Bellevue.

Locality.—Portion 42, Parish Wivenhoe (*F.* 1582).

TÆNIOPTERIS (? DANÆOPSIS) CRASSINERVIS (Feistm.).

(Plate XVIII., figs. 1, 2, and 3.)

Several specimens from Bellevue appear to be fertile examples of this species. The venation is similar to that in examples from Wycarbah (Walkom, 1917, Plate 1) in which the veins do not branch as frequently as indicated in Etheridge's description of the species (1892, p. 376).

The Bellevue specimens show a frond 8 cm. or more in breadth, with obtusely rounded apex; there is a very prominent midrib up to 8 mm. broad, striated longitudinally and, where eroded, showing internal structure consisting of an irregular series of anastomosing transverse strands. (Plate XVIII., fig. 1).

A similar structure appears to be present in some of the Indian specimens of *Danæopsis Hughesi* from the South Rewah basin, figured by Feistmantel (1882, pp. 25-27, Plates 4, 18) who, however, merely refers to this as transverse wrinkling of the rachis.

The secondary veins are almost at right angles to the midrib and are about 1 mm. apart; they branch but rarely and there are indications that they form a marginal vein at the edge of the lamina.

These secondary veins are in some specimens joined by a series of short irregular cross connections. Their irregularity lies in the fact that they are not always continuous from one vein to the next, but in these cases only reach about halfway. The explanation of this is provided by one specimen, of which the greater part shows the upper surface of the leaf, but in parts this is broken away and shows the series of transverse connections mentioned (Plate XVIII., fig. 1). Between the coarse veins in this specimen there can be seen one, occasionally two, very much finer veins (Plate XVIII., fig. 1). It is suggested that the cross connections mark the junction lines between adjacent sporangia and that the sporangia were aggregated in linear sori, placed between the veins and consisting of two rows of sporangia, the fine veins between the normal coarse ones marking the line of junction between the two rows of sporangia. Possibly where there are two of these fine veins the sporangia were more crowded and there were three rows. The dimensions of the sporangia would have been about $.75 \times .5$ mm. Apparently the whole of the under surface was covered with the contiguous sporangia.

Unfortunately no detailed structure of the sporangia is preserved and it can only be suggested that the above interpretation is the correct explanation of the structure.

Halle (1921, p. 1) has given a full discussion of the genus *Danaeopsis* and described a new species, *D. fecunda*, from fertile specimens. His specimens were well preserved and enabled him to work out the detailed structure of the sporangia.

I suggest the probability of the Australian *Tæniopteris crassinervis* belonging to *Danaeopsis*, whose relation to recent genera of Marattiaceous ferns, as pointed out by Halle, is by no means clear.

Although a number of species of *Tæniopteris* have been described from Australian Mesozoic rocks, and specimens are very abundant on certain horizons, no fertile examples have yet been recorded or figured. The present examples from Bellevue, therefore, mark an advance in our knowledge of this common genus among Mesozoic plants. Australian species have at times been referred to such genera as *Angiopteridium* and *Oleandridium*, but this reference has been based entirely on the form of the leaf and the venation. From time to time I have pointed out that, although no Australian examples of *Tæniopteris* had been found showing the fertile characters, the English species *T. vittata* had been assigned to the Cycadophyta by H. H. Thomas (1915) and I therefore suggested the possibility of the Australian species belonging to the Cycads. It would seem now that one species, *T. crassinervis*, can be reasonably believed to be a marattiaceous fern, and we must therefore bear in mind the probability of other of our species of *Tæniopteris* belonging to the ferns.

Sterile examples of *T. crassinervis* in the collection do not differ from previously described specimens. One example (*F. 1583*) is a rather abnormal leaf in that the lamina is different in breadth on the two sides of the midrib, and has a lobed margin (Plate XVIII., fig. 3).

Locality.—Portion 42, Parish Wivenhoe (*F. 1577*); Portion 24, Parish Esk (*F. 1583*).

TÆNIOPTERIS CARRUTHERSI Tenison-Woods.

(Text-fig. 3.)

(See Q'land Geol. Surv., Pub. 257, p. 34.)

A number of specimens are referred to this species. One of them (*F. 1486a*) shows venation nearer to that originally described for the species than any I have previously examined. In this the secondary veins make a very acute angle with the midrib, but maintain this direction only for a distance of about 1 mm., when they curve outwards, and for the rest of their course they are at right angles to the midrib (Text-fig. 3). The secondary veins branch at varying distances from the midrib; near the midrib there are about 24 per cm., while near the margin they are more numerous.

Locality.—Portion 32, Parish of Northbrook (*F. 1486a*).

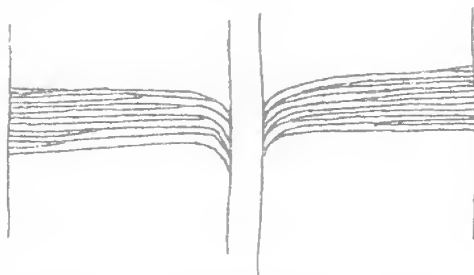


Fig. 3.—*Tæniopteris Carruthersi* Tenison-Woods. ($\times 2$)

TÆNIOPTERIS TENISON-WOODSI Etheridge Jr.

(See Q'land Geol. Surv., Pub. 257, p. 32.)

Several typical examples occur on a specimen from Portion 42, Parish Wivenhoe. They are narrow (6.5 to 8 mm. wide), strap-shaped, with acute apex, prominent midrib, and secondary veins making an acute angle with the midrib and branching occasionally.

Locality.—Portion 42, Parish Wivenhoe (*F. 1547*).

FILICALES INCERTÆ SEDIS.**? SPHENOPTERIS PECTEN** Halle.

Some specimens bear a close general resemblance to *Sphenopteris pecten* described by Halle (1913, p. 35) from the Mesozoic flora of Graham Land. The frond is bi- (or tri-) pinnate, the pinnæ being alternate or opposite, narrow, elongate. The pinnules (or segments) are short (4 mm. long by 1.5–2 mm. wide), somewhat acute, and as far as can be seen each has a single vein. On account of the imperfect preservation I am not prepared to say whether the rachis is winged as in the specimens described by Halle. Our example may be compared with Halle's figures (1913, Pl. 4, figs. 21, 21a). They also show a resemblance to *Scleropteris crassa* Halle, also from Graham Land (cf. Halle, 1913, Pl. 4, fig. 5) but in this species the venation is different.

No specimens at all resembling the one under consideration here have been recorded previously from Queensland Mesozoic rocks.

Locality.—Portion 24, Parish Esk (*F. 1580*).

(?) SPHENOPTERIS SUPERBA Shirley.

Specimen *F. 1551* resembles in general appearance this species from the Ipswich Series (Shirley, 1898, p. 18; Walkom, 1917, p. 27). The specimen is imperfect and does not show the venation. It may also be compared with specimens described as *Callipteridium stormbergense* by Seward (1903, p. 58) from the Stormberg Beds of South Africa, and others described by Halle (1913, t. 4, fig. 5) as *Scleropteris crassa* from Graham Land.

Locality.—Portion 42, Parish Wivenhoe (*F. 1551*).

CYCADOPHYTA.**(? NILSSONIA) SUPERBA**, n. sp.

(Plate XIX., fig. 1.)

Portions of some very large leaves are referred to a new species, placed doubtfully for the present in the genus *Nilssonia*. From the literature available to me it seems quite possible that the specimens represent a new genus, but, as none of them is complete, I hesitate to describe them as such. They seem

to be nearest to *Nilssonia* amongst the known Mesozoic genera, but there is a possibility also that they may represent a large species of *Tæniopteris*, such as *T. lata* from the Rajmahal Series in the Rajmahal Hills of India.

The leaves are large (length ?, breadth 24 cm. or more; in one specimen the length (incomplete) of a portion which is 13 cm. broad, is just over 13 cm.). The lamina is entire, traversed by numerous, simple, parallel veins (about 12 per cm.) almost at right angles to the rachis. In addition the lamina is coarsely wrinkled parallel to the veins, the wrinkles being most pronounced near the rachis and dying out before the margin is reached. As a result of the presence of these coarse wrinkles, the frond appears, on a casual glance, to be one of the Cycads such as *Zamites*, but closer examination leaves no doubt that the lamina is entire.

It is unfortunate that no complete examples have been found.

Locality.—Portion 42, Parish Wivenhoe (*F. 1463*).

PTEROPHYLLUM NATHANI, n. sp.

(Plate XX., figs. 1 and 2.)

Frond large; pinnæ long, narrow (to 5 cm. long, 5 mm. wide), parallel-sided, contiguous or distant, with bluntly pointed tips, slightly expanded at base; rachis prominent, 4-5 mm. wide, more or less wrinkled longitudinally; veins fine, 4-5 per mm., parallel, only occasionally branching.

The largest specimen is portion of a frond, 15 cm. long, the complete frond apparently being considerably longer.

Two specimens (*F. 1479* and *F. 1480*) are referred to this species, the only difference between them being that in *1479* the bases of the pinnæ are up to 4 mm. apart, whereas in *1480* they are contiguous. In the latter specimen the pinnæ became curled up before fossilisation, and as a result they appear to taper gradually to an acute point. (Plate XX., fig. 1.)

The determination and definition of many species of *Pterophyllum* are not easy, but the present specimens differ from species that have previously been described from Queensland in the proportions of the pinnæ (relative length and breadth) and in the fineness of the venation; whether they are conspecific with any of the species described from other parts of the world is difficult to determine without the opportunity of comparison with type material.

Pterophyllum Nathani may be compared with such species as *P. Jægeri* Brongniart from the Keuper of Stuttgart (cf. Seward, 1917, p. 553, fig. 610), with the description of which it agrees closely, except that the ends of the pinnæ are more rounded in *P. Jægeri*.

Other similar species are *P. æquale* recorded by Nathorst from the Rhætic of Scania, and by Zeiller from the Rhætic of Tonkin; *P. Braunianum*,

another Rhætic form, in which the pinnæ are narrower than in our specimens; and *P. Tietzei* from the Rhætic of Persia and Tonkin. A somewhat similar species occurs in the Burghersdorp Beds of Triassic age, in South Africa (Seward, 1908, p. 103).

Another species to which the present one shows some resemblance is *P. Kingianum* from the Jurassic (Liassic) flora of the Rajmahal Group (Feistmantel, 1877, Pl. 3, fig. 1 and Pl. 4, fig. 1).

The species is named in honour of Sir Matthew Nathan, Governor of Queensland, whose interest in the Queensland Museum was largely responsible for bringing this collection of fossil plants to that Institution.

Locality.—Portion 42, Parish Wivenhoe (*F. 1479*, *F. 1480*).

PSEUDOC TENIS EATHIENSIS (Richards).

(Plate XIX., fig. 2.)

(See Q'land Geol. Surv., Pub. 259, 1917, p. 19, Pl. 7.)

Further specimens, similar to those already recorded from several localities in the Esk district (Walkom, 1917*a*, p. 19), are in the Bellevue collection.

Locality.—Portion 24, Parish Esk (*F. 1486*); Portion 42, Parish Wivenhoe (*F. 1471*).

PODOZAMITES LANCEOLATUS (?) (Lindley and Hutton).

(Plate XXI., fig. 3-A.)

A few small lanceolate leaves, 2.5–3 cm. in length and 4 mm. wide, possibly belong to this species. Very similar isolated examples have been figured from India by Feistmantel (1877*a*, Plate IV.).

Locality.—Portion 42, Parish Wivenhoe (*F. 1469*).

GINKGOALES.

GINKGOITES SIBIRICA ? Heer.

(Plate XXI., fig. 4.)

(See Seward, Fossil Plants, Vol. IV., 1919, p. 24.)

The generic name *Ginkgoites* has been proposed by Seward (1919, p. 11) for fossil leaves that "it is believed belong either to plants generically identical with *Ginkgo* or to very closely allied types."

Specimen *F. 1553* may be referred to *G. sibirica*, first described by Heer from plant beds near Irkutsk in Siberia. This specimen agrees very

closely with a figure (Seward 1919, fig. 635e) reproduced after Heer's figure of the species. The species, as is the case with most species of *Ginkgoites*, shows considerable variation in the leaf form, and Seward (1919, p. 24) has suggested the retention of the name for "leaves similar to some of the more deeply divided forms of *G. digitata* and to *G. pluripartita*, but normally characterised by a lamina divided almost or quite to the base into oblong, obtuse or more or less acute segments."

The present example is a little over 5 cm. from base to outer margin; it is, near the base, divided into four segments, each about 1 cm. wide, and each of these segments is again divided twice. The veins divide frequently and there are about 18-20 per cm.

The specimen differs from any of those so far found in Queensland. It has not been considered advisable to suggest a new specific name for this example, in view of the wide distribution of certain types of *Ginkgo* leaf and the already long list of species described for this genus. *Ginkgoites sibirica* is mainly a Jurassic type.

The species *Baiera moltenensis* from the Molteno beds, of Rhætic age, in South Africa (Seward, 1908, p. 99) is somewhat similar to this Queensland specimen.

Locality.—Portion 24, Parish Esk (F. 1553.)

GINKGOITES DIGITATA (Brongniart).

(See Q'land Geol. Survey, Pub. 259, 1917, p. 8, Pl. 1.)

A single specimen belongs to this species. The leaf is only divided for a short distance from the margin, the indentations in no place reaching more than halfway towards the base. There is a very distinct median indentation, reaching nearly halfway to base, and several subsidiary ones. The whole margin does not show in the specimen, being partly broken or covered by rock. The leaf measures 3 cm. from base to margin and has the usual venation.

Locality.—Portion 24, Parish Esk (F. 1540).

GINKGOITES sp.

(Plate XXI., fig. 3-B.)

An isolated leaf is doubtfully referred to *Ginkgoites*. It is somewhat wedge-shaped, 3 cm. in length, 17 mm. broad in the upper part and 4.5 mm. at the base; it is traversed by veins, diverging from the basal portion, about 1 mm. apart and branching dichotomously at intervals.

Locality.—Portion 42, Parish Wivenhoe (F. 1469).

BAIERA BIDENS Tenison-Woods.

(Plate XXI., fig. 2.)

(See Q'land Geol. Surv., Pub. 259, 1917, p. 11, Pl. 3.)

This species, which has previously been recorded from Denmark Hill (Ipswich) and Yeronga (Walkom, 1917*a*, p. 11) is present in the collection from Bellevue, the specimen figured (*F. 1470*) being a fine example showing the form of the leaf.

Locality.—Portion 42, Parish Wivenhoe (*F. 1470*); Portion 24, Parish Esk (*F. 1546*).

BAIERA SIMMONDSI (Shirley).

Specimen *F. 1488* is probably portion of a leaf belonging to this species. The complete leaf is more than 12.5 cm. from base to outer margin, and is deeply divided into a number of segments. These segments appear to be broader than in any examples of the species that have come under my notice.

The species has previously been described from Denmark Hill (Ipswich) and Coal Creek near Esk. (See Walkom, 1917*a*, p. 10.)

Locality.—Portion 24, Parish Esk (*F. 1488*).

PHÆNICOPSIS ELONGATUS (Morris).

Specimen *F. 1475* shows a cluster of long narrow leaves for which possibly the generic name *Desmiophyllum* would be more suitable than *Phœnicopsis*. They are 14 cm. or more long, 1.5 cm. broad, and taper gradually to the base; they are traversed by a number (about 20) of parallel veins.

Similar specimens have been described from beds near Esk (Walkom, 1917*a*, p. 27) but this example is more complete than any hitherto described from Australia. It shows four leaves with their bases close together, suggesting the habit of such species as *Phœnicopsis speciosa* from the Jurassic of Siberia (Seward, 1919, p. 73).

Similar incomplete leaves have been described by Nathorst from the Rhætic beds of Sweden.

On the same specimen a stem of *Neccalamites hocrensis* lies near the bases of the *Phœnicopsis* leaves.

Locality.—Portion 42, Parish Wivenhoe (*F. 1475*).

GYMNOSPERMOUS SEEDS.

(1.) Specimen *F. 1469* shows an indistinct impression (*C*), possibly a gymnospermous seed. Only the general shape can be made out, the seed being oval in outline, its dimensions being 3 cm. x 2.2 cm. (Plate XXI., fig. 3, *C*.)

Locality.—Portion 42, Parish Wivenhoe.

(2.) On specimen *F. 1582* there is an example (Plate XVII., fig. 1, D) similar to one figured from Denmark Hill (Ipswich) (Walkom, 1917*a*, p. 27, Pl. 8, fig. 7). Attention was previously drawn to the resemblance exhibited by this type to the female flowers of *Ginkgo* (cf. Seward and Gowan, 1900, Pl. 9, fig. 6).

Locality.—Portion 42, Parish Wivenhoe.

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Explanation of Plates XV.--XXI.

Unless otherwise stated, figures are natural [size.

PLATE XV.

- Fig. 1.—*Neocalamites hoerensis* (Schimper). |
 Fig. 2.—*Cladophlebis lobifolia* (Phillips). (Slightly reduced.)
 Fig. 3.—*Thinnfeldia lancifolia* (Morris). (Slightly reduced.)

PLATE XVI.

Schizoneura sp. a. Fig. 1 ($\times .4$); Fig. 2 ($\times .3$).

PLATE XVII.

- Fig. 1—A, B. *Pecopteris (Asterotheca) Hillæ* Walkom. (Slightly reduced.)
 C. *Ginkgoites* sp.
 D. Gymnospermous seed.
 E. *Cladophlebis australis* (Morris).
 F. *Thinnfeldia Feistmanteli* Johnston.
 Fig. 2.—*Pecopteris (Asterotheca) Hillæ* Walkom. Sterile pinna. ($\times 2.5$.)
 Fig. 3.—*Pecopteris (Asterotheca) Hillæ* Walkom. Fertile pinna. ($\times 2.5$.)

PLATE XVIII.

- Fig. 1.—*Tæniopteris* (? *Danceopsis*) *crassinervis* (Feistm.). ($\times 2$.)
 About the middle of the figure and to the left of the midrib the finer veins between the coarse ones can be seen.
 Fig. 2.—*Tæniopteris* (? *Danceopsis*) *crassinervis* (Feistm.).
 Fig. 3.—*Tæniopteris crassinervis* (Feistm.).

PLATE XIX.

- Fig. 1.—(? *Nilssonia*) *superba* Walkom. ($\times .4$.)
 Fig. 2.—*Pseudoctenis eathiensis* (Richards). ($\times .8$.)

PLATE XX.

- Figs. 1, 2.—*Pterophyllum Nathani* Walkom. ($\times .75$.)

PLATE XXI.

- Fig. 1.—*Dictyophyllum rugosum* L. & H. ($\times .9$.)
 Fig. 2.—*Baiera bidens* Tenison-Woods. ($\times .8$.)
 Fig. 3.—A. *Podozamites lanceolatus*? (L. & H). ($\times .7$.)
 B. *Ginkgoites* sp.
 C. Gymnospermous seed.
 Fig. 4.—*Ginkgoites sibirica*? Heer.

CYLINDRICAL STONE IMPLEMENT.

BY E. O. MARKS, M.D., B.A., B.E.

Plate XXII., figures 1 and 2.

[Editor's Note.—The Queensland Museum recently received through Dr. E. O. Marks a sub-cylindrical stone implement 219 mm. in length, with a maximum diameter of 51.5 mm., tapering to 35 mm. The cutting edge is evenly chamfered, as shown in Plate XXII., figures 1 and 2. This implement is of such unusual contours that it is desirable to place Dr. Marks's notes on record.]

Discovery.—Mr. A. H. Blackman, Surveyor, who sent the stone implement to my father, has kindly supplied the following information in regard to its discovery. It was ploughed up from a depth of nine inches, during the preparation of the ground for a first cotton crop, on a flat spur of sandy loam which had previously been cleared of brigalow and sandalwood scrub. The locality is at the junction of Palm Tree Creek and the Dawson River, eight miles north a little east from Taroom, and one and a-half mile from the aboriginal settlement.

Description.—The implement has been made from an altered basic intrusive rock of the nature of a diabase, consisting of a fine-grained base, with numerous phenocrysts of dark mineral, probably a pyroxene, and occasional decomposed white phenocrysts. It has evidently been exposed to the weather for a considerable period, for the surface is roughened and pitted and covered by a brown ferruginous coating. The latter is probably largely the result of deposition upon the surface, but where scraped by the plough the coating is seen to merge into weathered rock, and this into the unweathered portion exposed in the deepest part of the cut.

PLATE XV.

Fig. 1.—*Neocalamites hoerensis* (Schimper). (Natural size.)

Fig. 2.—*Cladophlebis lobifolia* (Phillips). (Slightly reduced.)

Fig. 3.—*Thinnfeldia lancifolia* (Morris). (Slightly reduced.)



Fig. 1.



Fig. 3.

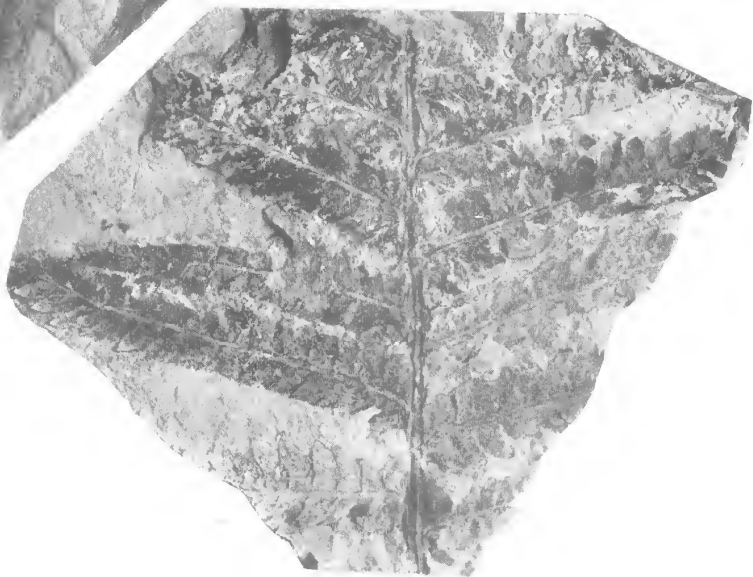


Fig. 2.

PLATE XVI.

Schizoneura sp. *a* Fig. 1 ($\times 4$); Fig. 2 ($\times 3$).



Fig. 1.

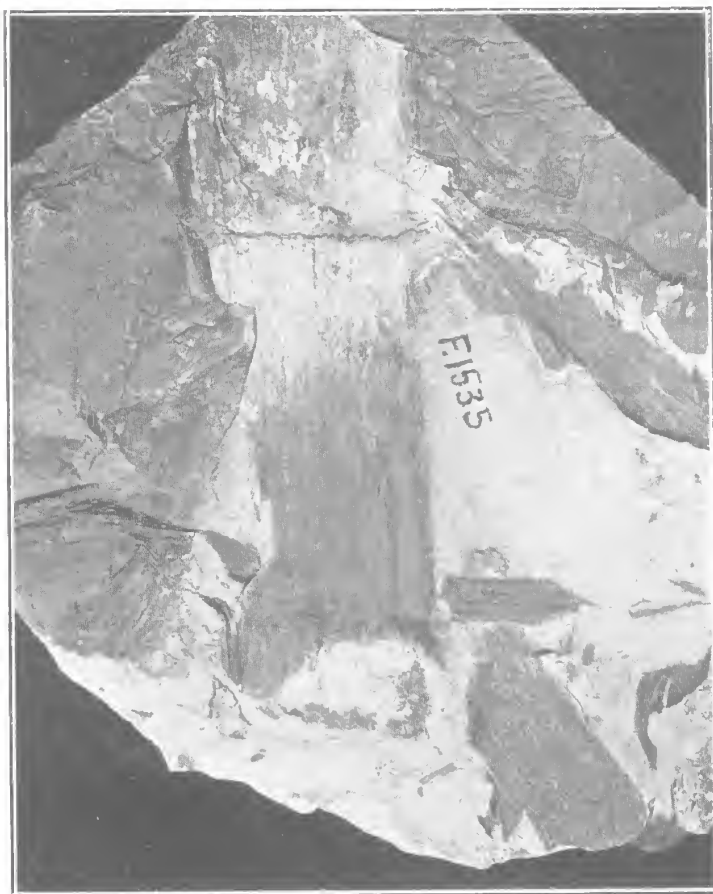


Fig. 2.

PLATE XVII.

Fig. 1.—A, B. *Pecopteris (Asterotheca) Hillæ* Walkom. (Slightly reduced.)

C. *Ginkgoites* sp.

D. *Gymnospermous seed*.

E. *Cladophlebis australis* (Morris).

F. *Thinnfeldia Feistmanteli* Johnston.

Fig. 2.—*Pecopteris (Asterotheca) Hillæ* Walkom. Sterile pinna. ($\times 2.5$.)

Fig. 3.—*Pecopteris (Asterotheca) Hillæ* Walkom. Fertile pinna. ($\times 2.5$.)



Fig. 1.

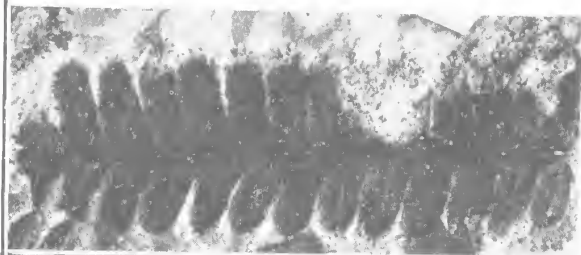


Fig. 2.



Fig. 3.

PLATE XVIII.

Fig. 1.—*Tæniopteris* (? *Danaopsis*) *crassinervis* (Feistm). ($\times 2$.) About the middle of the figure and to the left of the midrib the finer veins between the coarse ones can be seen.

Fig. 2.—*Tæniopteris* (? *Danaopsis*) *crassinervis* (Feistm). (Natural size.)

Fig. 3.—*Tæniopteris crassinervis* (Feistm). (Natural size.)

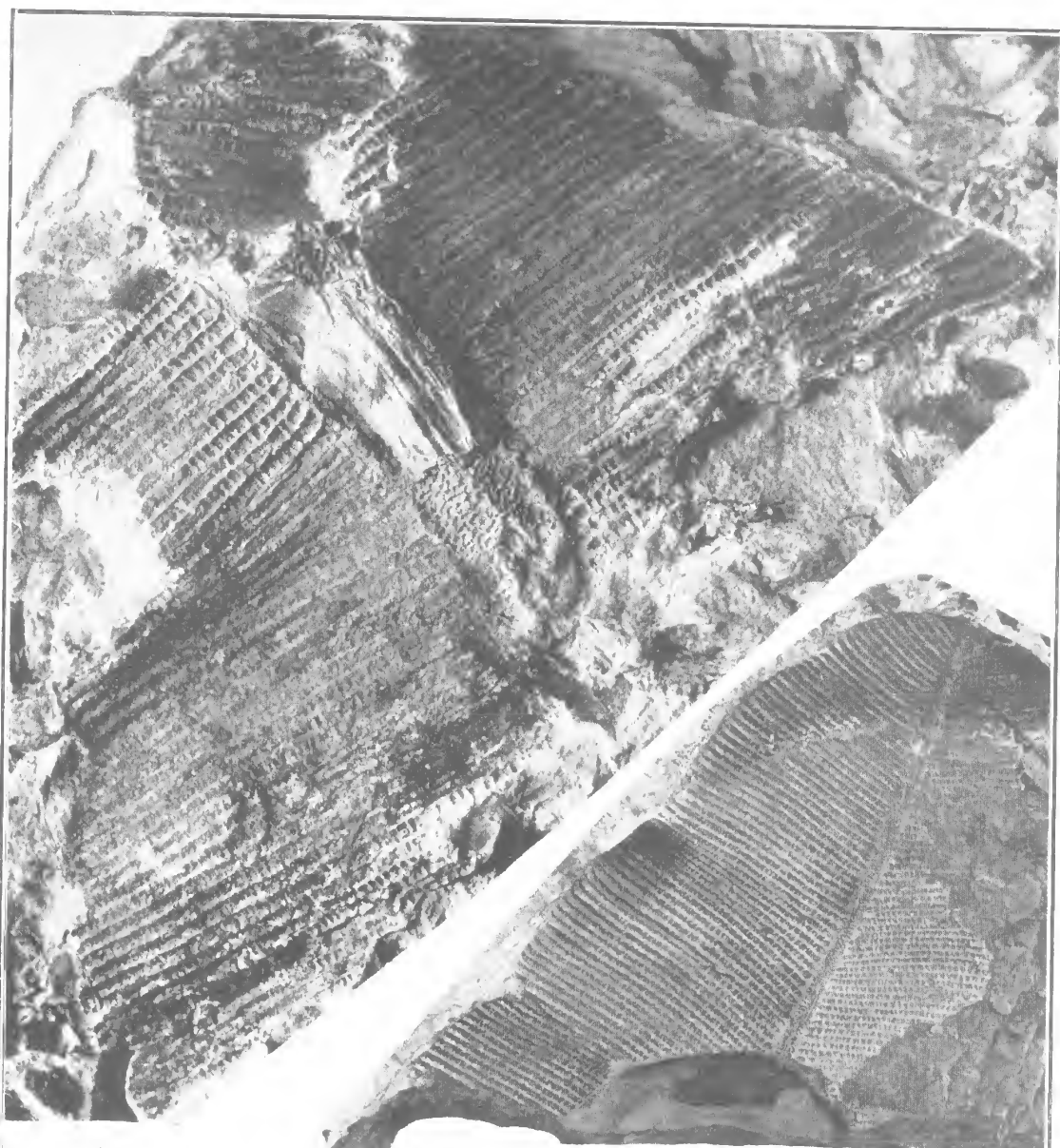


Fig. 1.

Fig. 2.

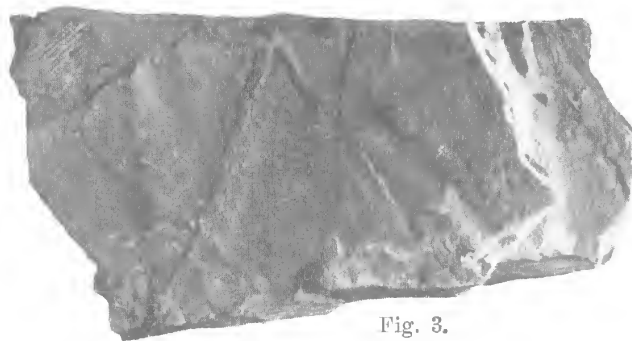


Fig. 3.

PLATE XIX.

Fig. 1.—(? *Nilssonia*) *superba* Walkom. ($\times 4$.)

Fig. 2.—*Pseudocentis cathiensis* (Richards). ($\times 8$.)

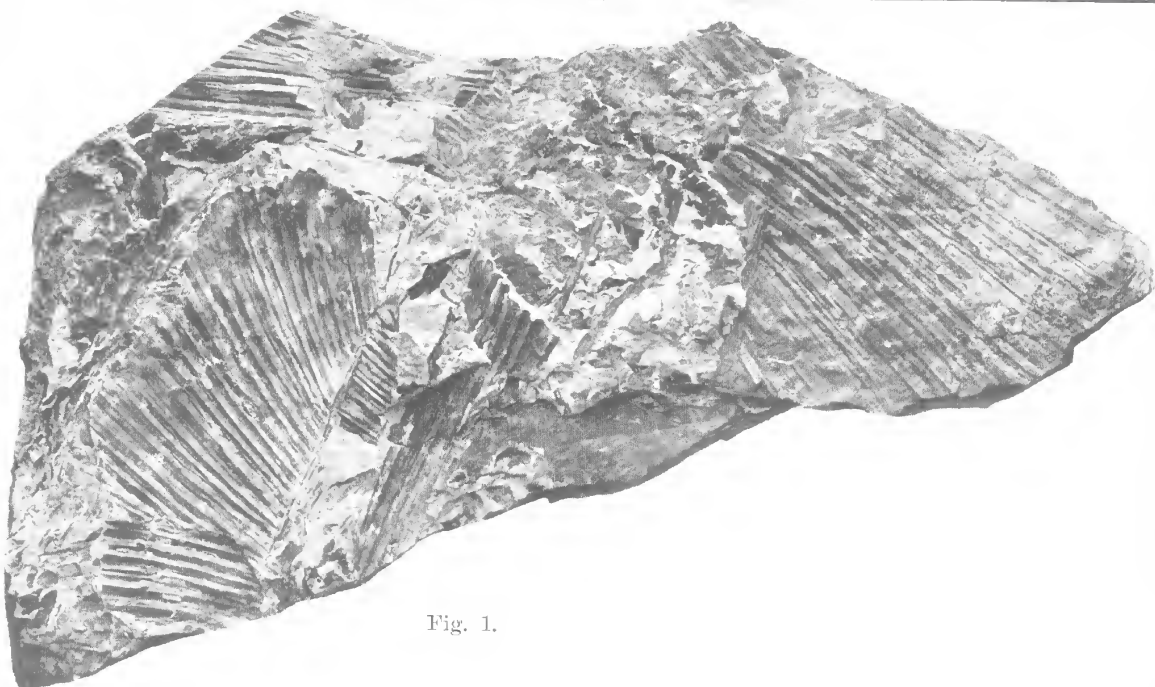


Fig. 1.

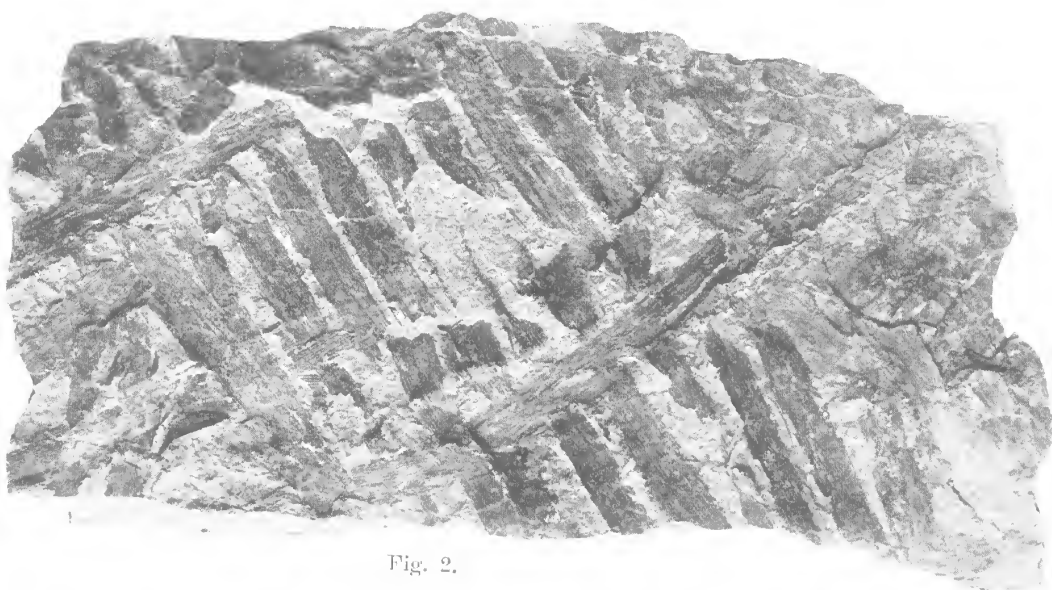


Fig. 2.

PLATE XX.

Figs. 1 and 2.—*Pterophyllum Nathani* Walkom. ($\times 75$.)

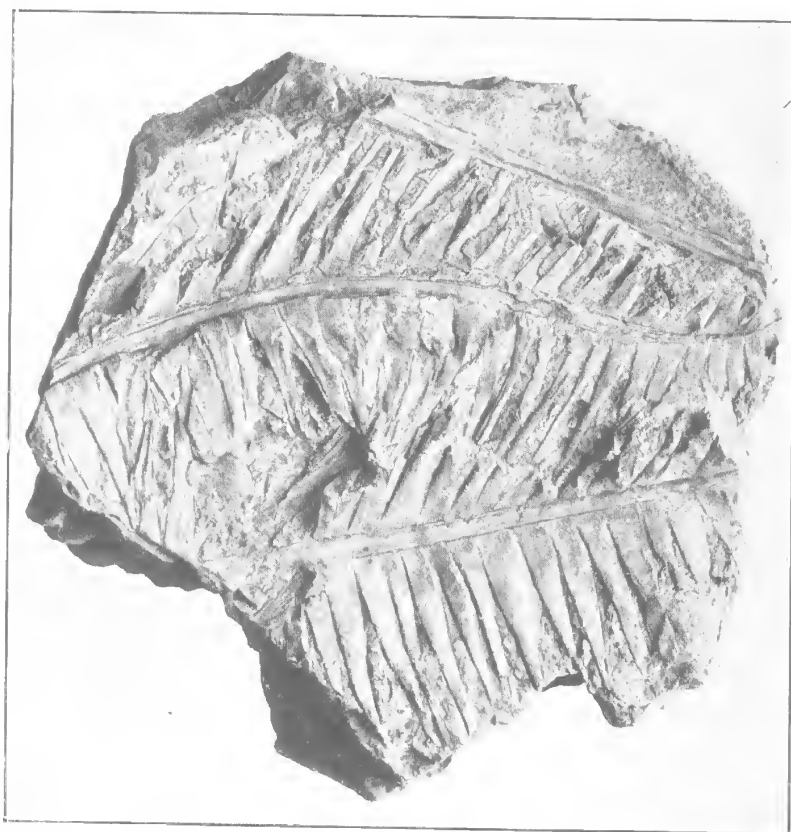


Fig. 1.

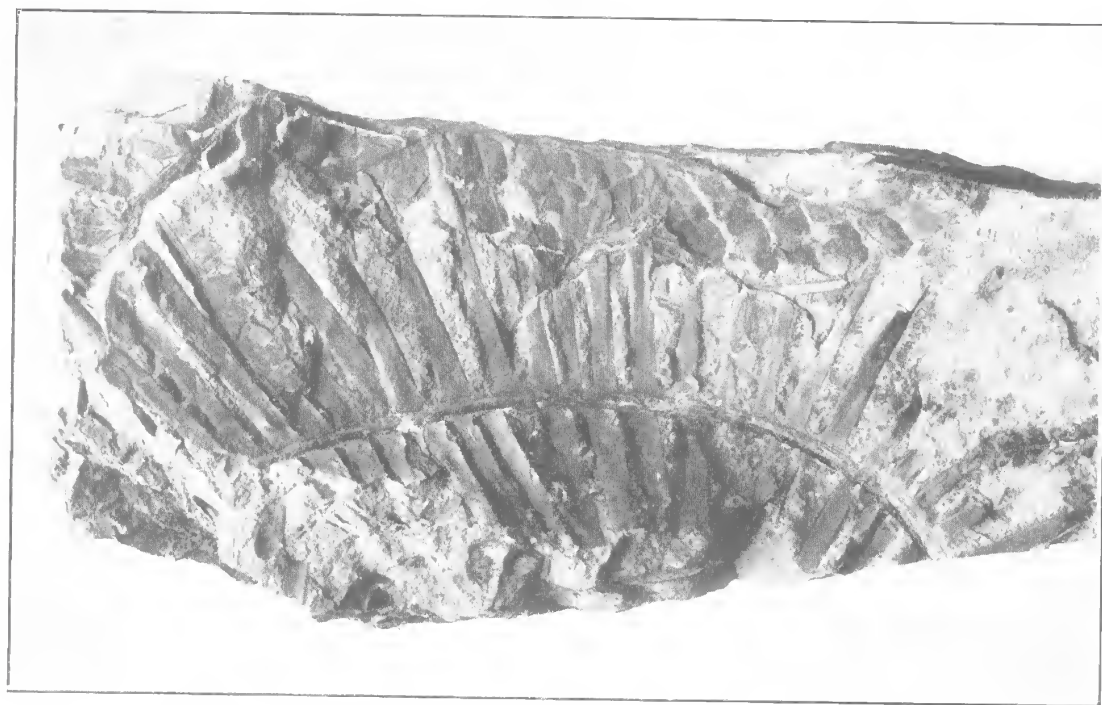


Fig. 2.

PLATE XXI.

Fig. 1.—*Dictyophyllum rugosum* L. & H. ($\times 9$.)

Fig. 2.—*Baiera bidens* Tenison Woods. ($\times 8$.)

Fig. 3.—A. *Podozamites lanceolatus* ? (L. & H.). ($\times 7$.)

B. *Ginkgoites* sp.

C. Gymnospermous seed.

Fig. 4.—*Ginkgoites sibirica* ? Heer. (Natural size.)



Fig. 1.



Fig. 3.



Fig. 2.



Fig. 4.





Figs. 1 and 2.—QUEENSLAND STONE IMPLEMENT.

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